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Proceedings Overview: Eighth Annual Gulf of Mexico Information Transfer Meeting

December 1987

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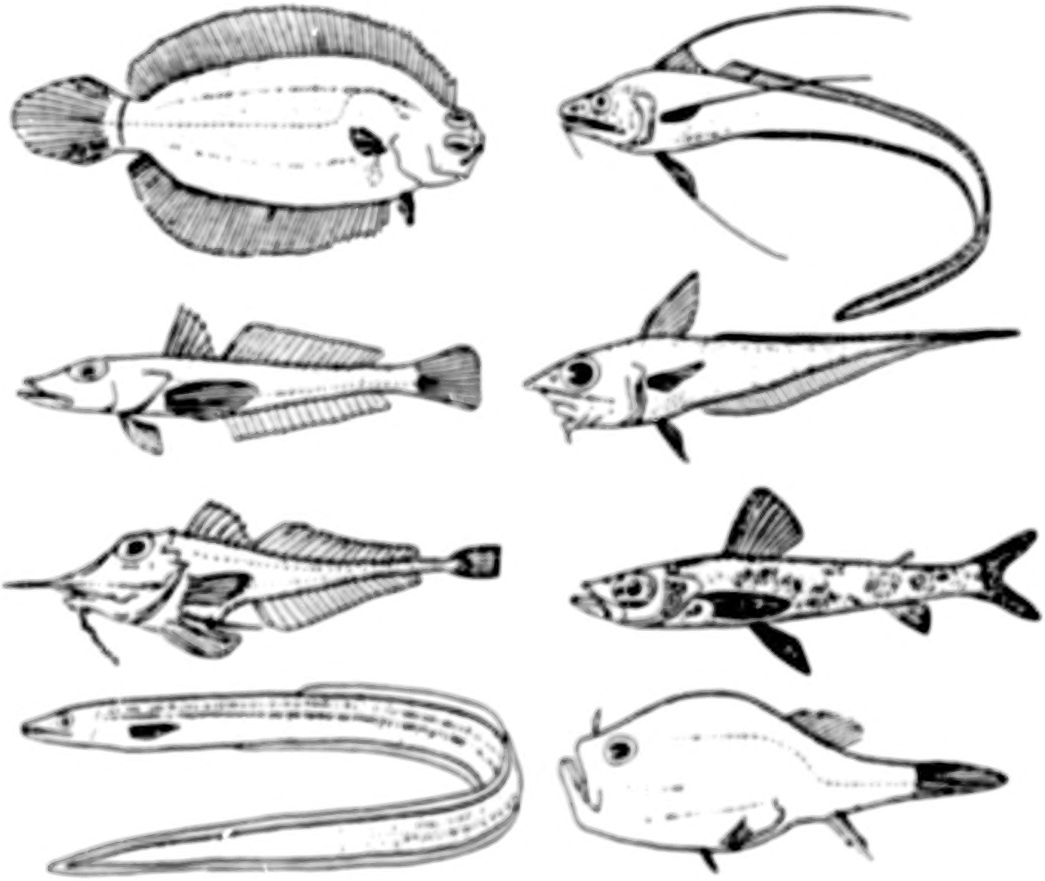

MMS U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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OCS Study
MMS 88-0027

Proceedings Overview: Eighth Annual Gulf of Mexico Information Transfer Meeting

December 1987

Doubletree Hotel
New Orleans, Louisiana

December 1-3, 1987

Author

Minerals Management Service
Gulf of Mexico OCS Region

Prepared under MMS Contract
14-12-0001-30305
by
Geo-Marine, Inc.
1316 14th Street
Plano, Texas 75074

Published by

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office
New Orleans, Louisiana

July 1988

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CITATION

This study should be cited as:

Minerals Management Service. 1988. Proceedings overview: eighth annual Gulf of Mexico information transfer meeting, December 1987. U.S. Dept. of the Interior. Minerals Management Service. New Orleans, LA. MMS Contract No. 14-12-0001-30305. OCS Study MMS 88-0027. 99 pp.

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ABOUT THE COVER

Cover artwork is the work of Mrs. Jan Fechhelm and originally appeared in the report to the Minerals Management Service (MMS) *Northern Gulf of Mexico Continental Slope Study Annual Report Year 3, Volume II: Technical Report* (OCS Study MMS 87-0060). This report was prepared under MMS Contract 14-12-0001-30212 by LGL Ecological Research Associates, Inc. and Texas A&M University. These deep-sea fishes are as follows:

- *Poecilopsetta beani*
- *Bembrops gobioides*
- *Peristedion grayae*
- *Synaphrobranchus oregoni*
- *Gadomus longifilis*
- *Coelorinchus coelorhynchus*
- *Chloropthalmus agassizi*
- *Chaunax pictus*

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PREFACE

This Proceedings Overview volume presents concise summaries of the several sessions and panel discussions of the Eighth Annual Information Transfer Meeting (ITM) held on December 1-3, 1987, in New Orleans, Louisiana. These ITM's are sponsored by the Minerals Management Service (MMS), Gulf of Mexico OCS Regional Office, to foster fruitful exchanges of information among Federal and State agencies, the petroleum industry, academia, and the interested public at large.

This volume includes session overviews by the respective session chairpersons only. At a later date the MMS will release an expanded Proceedings volume that will contain both session overviews by each of the session chairpersons as well as short accounts of the presentations by the authors.

This overview is intended as a summary document for those requiring less technical detail than will appear in the final Proceedings volume. The MMS invites comments and constructive criticism on these annual meetings and the resulting Proceedings.

Special thanks are extended to all ITM participants: the MMS staff responsible for planning and conducting the meeting; the invited speakers who have given their time and energies to share information with all attendees; and the staffs of Geo-Marine, Inc., the University of Southern Mississippi's Department of Conferences and Workshops, and the Doubletree Hotel, who have provided excellent logistical support for the meeting. The Minerals Management Service also thanks Geo-Marine, Inc. and the Economic Development Council and its Petroleum Committee of the Chamber of Commerce/New Orleans and River Parishes who each provided attendees with enjoyable receptions.

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OPENING PLENARY SESSION

Session: OPENING PLENARY SESSION

Co-Chairs: Dr. Richard Defenbaugh
Mr. Ruben G. Garza

Date: December 1, 1987

Presentation Title	Author/Affiliation
Session Welcome, Introductions, and Announcements	Dr. Richard Defenbaugh Minerals Management Service Gulf of Mexico OCS Region
Environmental Research: How Much Is Enough?	Dr. Robert J. Livingston Florida State University Center for Aquatic Research and Resource Management
Environmental Risk Research: How Much is Enough?	Dr. John Cairns, Jr. Virginia Polytechnic Institute and State University University Center for Environmental and Hazardous Materials Studies

Opening Plenary Session
Overview

Dr. Richard Defenbaugh
Minerals Management Service
Gulf of Mexico OCS Region

The primary purposes of the Opening Plenary Session are to welcome attendees to the Information Transfer Meeting (ITM) and to initiate the meeting with one or two major presentations that are of interest to a broad cross-section of meeting attendees and are pertinent to the interests of the Minerals Management Service's (MMS) Gulf of Mexico Outer Continental Shelf (OCS) Regional Office.

The ITM was called to order by Mr. Garza, who welcomed attendees, introduced the staff responsible for meeting logistical support, made appropriate housekeeping announcements, and introduced Dr. Defenbaugh, who discussed the purposes and functions of the ITM and introduced subsequent speakers.

The primary purposes of the ITM are to provide a forum for "scoping" topics of current interest or concern relative to environmental assessments or studies in support of offshore oil and gas activities in the Gulf of Mexico OCS Region; to present the accomplishments of the MMS Environmental Studies Program for the Gulf of Mexico, and of other MMS research programs or study projects; to foster an exchange of information of regional interest among scientists, staff members, and decisionmakers from MMS, other Federal or State governmental agencies, regionally important industries, and academia; and to encourage opportunities for attendees to meet and develop or nurture professional acquaintances and peer contacts.

The ITM agenda is planned and coordinated each year by the MMS Gulf of Mexico OCS Regional Office staff around the three themes mentioned above--issues of current interest to the Region or the MMS oil and gas program, accomplishments of the agency, and regional information exchange. All presentations are invited, through personal contacts between session chairpersons and the speakers, and meeting support funding is provided through the MMS Environmental Studies Program. All meeting logistical support is provided by a contractor (Geo-Marine, Inc.) and subcontractors selected through the usual Federal procurement process. A proceedings volume is prepared for each ITM, based on abstracts of brief technical papers submitted by each speaker and on session overviews prepared by each session chairperson.

Mr. Pearcy, Regional Director of the MMS Gulf of Mexico OCS Region, formally welcomed the audience on behalf of the MMS and extended special welcomes to members of the MMS Director's "Take Pride Gulf Wide" Task Force (a group concerned about marine and littoral debris) and of the Gulf of Mexico Regional Technical Working Group (a committee of the MMS OCS Advisory Board) holding meetings concurrently with the ITM. Mr. Pearcy commented briefly on the scope and nature of ITM sessions and presentations and on the utility of the ITM in sharing information on current issues of concern to MMS.

Our two Plenary Speakers were Dr. Robert Livingston and Dr. John Cairns, Jr., who spoke on the themes of "How much environmental research is enough?" and "How much environmental risk research is enough?", respectively. These themes were selected because the trend for the MMS Environmental Studies Program for the Gulf of Mexico is clearly shifting away from descriptive studies to studies of assessment and prediction of the impacts of offshore oil and gas activities, including chronic and toxicological effects and to long-term monitoring of both natural sites and sites of OCS development. Banes of previous research have included wide-ranging natural variability and inconclusive or unconvincing results. Dr. Livingston has conducted long-term (>20 years) environmental studies focused on understanding natural variability of coastal study sites in the northeastern Gulf of Mexico, and Dr. Cairns has conducted extensive research on marine and aquatic ecology, toxicology, and hazard assessment.

Dr. Livingston pointed out that the answer to the question "How much environmental research is enough?" depends on the specific question at hand, but involves hypothesis testing using an appropriate, well-managed database.

Marine ecology is a young science, still in its early, descriptive phase. Our understanding of how marine ecosystems work is still poor and is impeded by the scale of natural variability of populations of marine organisms and by variability and interactions of subsystems of a marine ecosystem.

Dr. Livingston advised that key points include scaling of the research effort appropriate to the resource under study for protection or understanding; identification of "key" environmental factors; planning appropriate field monitoring studies; quantification of sampling techniques to be used in field studies; and analysis of data supported by an effective data processing system and aimed at modeling for predictive purposes.

To illustrate these points, Dr. Livingston presented data from his studies of Choctawhatchee Bay, where various communities reflected influences of environmental factors (salinity, habitat type, severe storms, etc.) or interactions with each other. Especially interesting were points made by Dr. Livingston of "guild organization" of organisms, and of use of microcosms to link field and laboratory studies.

Biologic guilds identified by Dr. Livingston and his co-workers were characterized by feeding mode, by trophic level, by reproductive mode, by locomotive means, and by body form. It was observed in the ecosystem under study that particular species of organisms might appear or disappear, but that each guild was always represented. Also, that some species (pinfish were presented as an example) progress through various habitat niches and biologic guilds throughout their life cycles, providing a continuum of guild associations over time and space in which various life stages coexist rather than compete.

Dr. Livingston presented a very interesting series of slides which addressed the question of sampling frequency and timing. Using an extensive database of weekly sampling at study sites, data subsets were graphed to see how well monthly sampling represented environmental trends observed in the entire database. Also, a database of monthly sampling was examined to see how quarterly sampling, initiated during January, then February, then March, represented trends observed in the complete database. In some cases, the data subsets represented the full data sets well; in other cases, major environmental trends or events were "lost." Interestingly, the three quarterly subsets of monthly data showed major differences when compared to each other.

Dr. Livingston closed his talk with remarks on his use of microcosms (small to large artificial ecosystems, representative of natural ecosystems) based on biologic guilds, which have shown good potential for studies aimed at predictive environmental assessments.

Dr. Cairns focused on the theme of "How much environmental risk research is enough?" He began his presentation with a figure that related hazard identification, hazard assessment, and hazard control. And he stated that "enough" information is needed to define uncertainty for informed decisions about risk, considering the known or expected concentration of a pollutant in the environment, and the concentration at which adverse biological effects are observed.

The amount of information needed for decisionmaking varies, depending on (1) relative concentrations of a pollutant in the environment and the concentration at which adverse biological effects occur; and (2) on the social benefit derived by allowing pollutant occurrence, as compared to the environmental consequences.

Dr. Cairns described phases of hazard evaluation: (1) screening toxicity tests, (2) predictive toxicity tests, (3) confirmative or validating toxicity tests, and (4) monitoring. Validation that considers "real world" conditions, as contrasted to laboratory test conditions, is of paramount importance. Primary data, developed by laboratory testing procedures, must by validated in a natural system or a test system with a high degree of "environmental realism." Mesocosms of various designs can provide appropriate realism.

Plenary Session attendees learned from Drs. Livingston and Cairns that the remark of one scientific quipster that "There's never enough data" is not always true. The questions that may be answered will depend on the nature of data at hand, on the means for analyzing those data, and on the nature of the decision to be made. Prudent research design must ponder the eventual application of results to assure that appropriate data are gathered.

Dr. Richard Defenbaugh is Chief of the Environmental Studies Section of the MMS Gulf of Mexico OCS Regional Office. His graduate work at Texas A&M University led to a M.S. in 1970 and a Ph.D. in 1976. He has been involved with the MMS/BLM environmental studies and assessment programs since 1975.

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SOCIAL AND ECONOMIC EFFECTS OF THE RECENT DECLINE IN OCS ACTIVITY ON GULF COAST COMMUNITIES

Session: SOCIAL AND ECONOMIC EFFECTS OF THE RECENT DECLINE IN OCS ACTIVITY ON GULF COAST COMMUNITIES

Co-Chairs: Mr. John Rodi
Ms. Vicki Zatarain

Date: December 1, 1987

Presentation	Author/Affiliation
Social and Economic Effects of the Recent Decline in OCS Activity on Gulf Coast Communities: Session Overview	Mr. John Rodi and Ms. Vicki Zatarain Minerals Management Service Gulf of Mexico OCS Region
Social and Economic Effects of the Decline in OCS Activity on the Houston Area	Mr. Albert Ballinger University of Houston
Social and Economic Effects of the Decline in OCS Activity on the New Orleans Area	Ms. Virginia Simons The Chamber/ New Orleans and the River Region
Social and Economic Effects of the Decline in OCS Activity on the Lafayette Area	Dr. David P. Manuel University of Southwestern Louisiana
Discussion of MMS In-House Research into OCS-Related Impacts on Tourism and Recreation	Mr. Douglas J. Elvers Minerals Management Service Gulf of Mexico OCS Region

Social and Economic Effects of the Recent Decline in OCS Activity on Gulf Coast Communities: Session Overview

Mr. John Rodi
and
Ms. Vicki Zatarain
Minerals Management Service
Gulf of Mexico OCS Region

The Gulf of Mexico offshore oil and gas industry has experienced significant changes over recent years. Indicative of these changes is the trend in Federal offshore mobile rig utilization. Offshore rig utilization increased dramatically from mid-1983 through the fourth quarter of 1984. By the first quarter of 1985, the recognition of a continued excess supply of oil and gas worldwide halted the growth of offshore drilling activity in the Gulf of Mexico. Wellhead prices of oil and gas showed a declining trend throughout 1985 before plummeting to about 50 percent of the 1985 year-end prices by the second quarter of 1986. In that period, mobile rig utilization had decreased accordingly. The first three quarters of 1987 have shown an increase in energy prices and, therefore, an increase in offshore mobile rig utilization, but the current demand is still about half of the peak of 1984.

The purpose of this session was to discuss the socioeconomic effects of the decline in OCS oil and gas activity over recent years on specific coastal communities throughout the Gulf of Mexico region. The coastal communities represented were Houston, New Orleans, Lafayette, and the Mississippi Gulf Coast. Additionally, status of an MMS in-house study on the impact of the oil and gas program on recreation and tourism was presented.

Mr. Albert Ballinger with the Center for Public Policy of the University of Houston presented the effects of the decline in oil and gas activity on the Houston area. The Center for Public Policy has been conducting research on the Houston economy and updates its findings on a quarterly basis with a "Houston Update."

Houston's role as an "energy economy" is that of manufacturing capital goods for exploration and production, and supplying technology for the industry. As a result, when the rig count plummeted, manufacturing employment in Houston (which was very heavily tied to energy) fell precipitously.

Because of the rapid growth in the 1970's and early 1980's of employment in the primary sector (those industries contributing to the export base of the economy), including rapid expansion in manufacturing and mining, and the growth lag in secondary employment, Houston found itself with an oversupply of residential, manufacturing, office, and retail space when the decline in oil and gas activity was felt. This is illustrated in the home price index. Demographic shifts have also been striking. The dramatic decreases in housing prices have allowed traditional minorities to pretty well settle where they desire, leaving Houston a city achieving a measure of radical integration unrivaled even by cities where targets of integration exist.

The post-1981 economic downturn is separated into two phases: 1982-1983 and 1985-1986. The earlier phase was felt largely by blue-collar workers while the second phase was primarily a white-collar recession.

Houston has begun to diversify, although the city will remain heavily energy dependent for the foreseeable future. Houston is expected to achieve modest growth through 1989 due to stabilizing energy prices and the diversification of the area's economic base.

Ms. Virginia Simons, the Manager of Petroleum and Chemical Development for the Economic Development Council of The Chamber/New Orleans & the River Region, presented the effects of the decline on the New Orleans area.

Louisiana has been the center of offshore activity since 1947. With offshore exploration and production activity came oil and gas company employment in southern Louisiana. Direct oil and gas mining employment now accounts for 22,000 jobs in the New Orleans area, increasing 600 percent since 1950. Oil- and gas-related employment grew rapidly during the 1970's as a result of world market conditions and the importance of Louisiana offshore activity. From 1981 to 1986, New Orleans lost 5,500 direct oil and gas jobs and 28,800 related jobs. However, New Orleans, as an offshore exploration and production center fared proportionately better than many other Gulf Coast communities.

The worst effects of the decline in OCS activity were felt in the indirect support businesses--the drilling, crewboat, fabricating, and offshore service companies. The downturn in employment led to decreases in other sectors—retail sales, real estate, and banking. Hotels and restaurants soon realized that a lot of what they called "tourism" was oil and gas travel.

Another major effect of the decline in prices was on State government revenues. Louisianians are now realizing that State revenues were too dependent on one source and that Louisiana's windfall from oil and gas has not been invested wisely. These problems lead to changes in State government leadership and to a campaign for fiscal reform.

Economic diversification is now underway. The Gulf of Mexico is a proven market and is the first offshore area showing strong signs of recovery with the stabilization of energy prices. Being a center for offshore activity, New Orleans is experiencing a slow but steady improvement in economic conditions, but the situation will never equal the boom of 1981.

Dr. David Manuel, Professor of Economics and Dean of the College of Business Administration of the University of Southwestern Louisiana, presented the social and economic effects of the decline in OCS activity on the Lafayette area.

Activity in the Gulf of Mexico OCS has greatly affected Lafayette because of the area's energy-industry dependence. The extraordinary rise in oil prices from 1977-1982 and the resultant increase in offshore oil and gas activity have caused significant growth in real per capita income in Lafayette as well as an influx of population and, therefore, a growth in the labor force.

The decline in OCS activity has resulted in the most precipitous decline in economic activity in Lafayette since the Great Depression of the 1930's. As a result, it has been estimated that 19,000 jobs have been lost in the Lafayette region since 1980, and a total of $2.0 billion in retail sales have evaporated.

While recovery is estimated to be slow to moderate, there is evidence that it is occurring. The unemployment rate, which had virtually tripled in a 6-year period, stabilized at about 10 percent in September 1987. The Lafayette Index of Help-Wanted Advertising confirms this modest improvement, showing greater employment availability in 1987. Similar to the experience in the New Orleans area, the recovery is being driven by OCS activity.

Mr. John Rodi, presenting information gathered through contacts with Mississippi Gulf Coast representatives, concluded that the impacts of the decline in OCS activity on the Mississippi Gulf Coast have not been devastating or even totally negative. Tourism in Mississippi coastal areas was generally unaffected or, in some cases, slightly increased throughout the decline in OCS activity. Some of those contacted hypothesized that this may have resulted from both increased travel by those recently unemployed in nearby Louisiana, as well as those still employed who chose to economize on vacation plans by remaining close to home. Another positive impact experienced by the Mississippi Gulf Coast has been the increase in ship and rig repair in the Pascagoula area due to companies' taking advantage of slack time to repair their fleet, or new owners refurbishing a fleet that was acquired during the downturn.

The final presentation was by Mr. Douglas Elvers, Chief of the Environmental Assessment Section of the Leasing and Environment Division of MMS, Gulf of Mexico OCS Region. He presented current leasing statistics and is currently preparing a paper that relates offshore oil and gas activity to tourism and recreation throughout the Gulf of Mexico region. Particular emphasis will be placed on the following areas where tourism and recreation are felt to be historically important: South Padre Island, Corpus Christi, Galveston/Point Bolivar, New Orleans, Grand Isle, the Mississippi Gulf Coast, Mobile, Gulf Shores, Dauphin Island, and the Florida Panhandle. This paper will be presented in August 1988 at the International Geographers' Union to be held in Australia.

Mr. John Rodi has been employed as staff economist with the MMS Gulf of Mexico OCS Regional Office from April 1980 to the present. He holds a B.A. in economics from Tulane University (1974), an M.A. in economics from the University of New Orleans (1978), and was employed for six years as an economist with the U.S. Army Corps of Engineers (1974-1980).

Ms. Vicki Zatarain is an economist with the Leasing Activities Section of the MMS Gulf of Mexico OCS Regional Office. She earned an M.A. degree in economics and a B.S. degree in marketing from the University of New Orleans and a B.S. degree in computer information systems from Tulane University.

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INFORMATION DEVELOPMENTS AND SOLUTIONS TO MARINE DEBRIS IN THE GULF OF MEXICO

Session: INFORMATION DEVELOPMENTS AND SOLUTIONS TO MARINE DEBRIS IN THE GULF OF MEXICO

Co-Chairs: Mr. Villere C. Reggio, Jr.
Mr. Richard T. Bennett

Date: December 1, 1987

Presentation	Author/Affiliation
Information Developments and Solutions to Marine Debris in the Gulf of Mexico: Session Overview	Mr. Villere C. Reggio, Jr. Minerals Management Service Gulf of Mexico OCS Region
Marine Debris on the Beaches of Padre Island National Seashore	Ms. Leslie Peart Corpus Christi State University
Survey and Findings of Beach Debris on Mustang Island, Texas	Mr. Anthony F. Amos The University of Texas at Austin Marine Science Institute
Preliminary Findings for Beach Debris in Louisiana	Ms. Dianne Lindstedt and Mr. Joseph Holmes Louisiana Geological Survey
Louisiana Coastal Recreation and Tourism Assessment Team: An Innovative University Approach	Mr. Michael L. Liffmann Louisiana Sea Grant College Program
NOAA's Marine Entanglement Research Program: Goals, Products, Information, and Plans	LCDR Alan R. Bunn National Oceanic and Atmospheric Administration
The Offshore Oil and Gas Industry's Campaign to Stop Offshore Littering	Mr. Wayne Kewley Offshore Operators Committee
Education and Awareness: Keys to Solving the Marine Debris Problem	Ms. Kathryn J. O'Hara Center for Environmental Education
Texas Adopt-A-Beach Program	Mr. Frank H. Morgan Texas General Land Office
Panel Reports: 1987 Gulf of Mexico Beach Cleanup Highlights (Texas, Louisiana, Mississippi, and Florida)	Ms. Linda Maraniss Center for Environmental Education, Mr. Calvin Fair Louisiana Coastal Cleanup, and Ms. Gail Bishop Gulf Islands National Seashore

Information Developments and Solutions to Marine Debris in the Gulf of Mexico: Session Overview

Mr. Villere C. Reggio, Jr.
Minerals Management Service
Gulf of Mexico OCS Region

When mineral revenues to state coffers in Texas and Louisiana started to tumble several years ago, state support for many local programs, such as beach maintenance in Texas, suffered precipitous declines as well. Texas coastal communities began to look anew at the economic potential of Gulf of Mexico beaches at the same time the financial resources for maintaining those beaches were drying up. Hence, coastal trash and litter became an issue, and people began to question its source. Surveys, opinions, information, and reports from Padre Island National Seashore (PINS) and coastal communities indicated the ever visible offshore oil and gas industry was a major source of the beach litter problem.

A 1985 formal report by the State of Texas concluded 75-90 percent of beach litter and trash came from offshore sources and implied the oil and gas industry was the primary contributor. Furthermore, over 300 unidentified 55-gallon drums, many of which were determined to contain hazardous waste, washed up on PINS in 1985. Hence, Federal and State regulatory agencies responsible for the environmental implications of oil and gas leasing and development in the Gulf of Mexico, as well as the petroleum industry itself, were called to task to correct this unacceptable and costly problem.

The MMS and the Texas General Land Office (TLO) began their own investigations of the problem while they were reviewing regulations pertaining to solid waste handling and disposal associated with oil and gas operations in the Gulf of Mexico. Even though State and Federal regulations already prohibited the disposal of solid waste materials from oil and gas activities anywhere in the marine environment, regulatory reminders and stern warnings were issued and communicated to the oil and gas industry with a call for special compliance efforts and exceptional voluntary actions to counter indiscriminate disposal and careless loss of solid waste from oil and gas operations. Also in 1986, the MMS, the TLO, several major oil companies, and others accepted the invitation of the Center for Environmental Education (CEE) to join their advisory committee in preparation for the first Texas statewide beach cleanup designed to remove beach litter, generate information on its source and contents, and foster public understanding on the scope, nature, and deleterious effects of marine debris.

For the third consecutive year, the Gulf of Mexico OCS Regional Office of MMS organized a session at the annual ITM focusing on marine debris. In 1985, the National Park Service, the U.S. Coast Guard, the State of Texas, and representatives of the major Gulf industries (petroleum, shipping, fishing, and recreation) were asked to present their views on the problem (OCS Study/MMS 86-0073, pp. 295-314). In 1986, the petroleum industry and the U.S. State Department described legal and educational actions underway to effect a significant reduction in marine litter. Specifically, the educational video "All Washed Up," produced by the Offshore Operators Committee (OOC), and Annex V of the MARPOL International Treaty were reviewed as major new measures pursued by the petroleum industry and the U.S. Government in response to this problem (OCS Study/MMS 88-0058, pp. 323-348). Since last year's ITM, the U.S. Congress has drafted and is favorably considering implementing legislation for Annex V, and the TLO has spearheaded a special initiative to have the Gulf of Mexico declared a special area under Annex V, thereby prohibiting disposal of all solid wastes from all ships (industries) throughout the Gulf of Mexico.

Presentations at this year's ITM were designed to share new information on the sources and nature of the debris on beaches of the Central and Western Gulf Planning Areas and to review the progress of institutions, individuals, and organizations active in litter removal and educational campaigns.

Ms. Leslie Peart, a candidate for a master of science degree at Corpus Christi State University, reported on the results of her two years of research on the trash load impacting PINS. Her findings indicated a total annual accumulation of 580 tons of trash and litter on the 58 miles of Gulf front beach associated with the seashore, and she attributed up to 40 percent of this trash by weight to the oil and gas industry. From data collected on her survey plots, she estimated a standing mass averaging between 1 and 3.3 tons per mile over the length of the seashore with greater density in the winter than in the summer. Importantly, she noted a 70 percent decline in standing mass and density of trash and litter within her survey plots when comparing early samples from those collected in the latter part of her survey. Using these findings she urges continued support for volunteer beach cleanups as an effective means to reduce beach trash loads, and encourages public and private educational programs targeted on the problem. Legislative remedies imposing deposits on recyclable containers were also recommended by Ms. Peart.

Mr. Tony Amos, a Research Associate at the University of Texas Marine Science Institute at Port Aransas, has been regularly surveying the same 7.5 miles of beach at Mustang Island for over 10 years. He has made over 1,300 daily observations of the flotsam and jetsam found on Mustang Island Beach and has noted that items associated with the oil and gas industry have definitely declined in the last year or two. Besides keeping tabs on natural and manmade items found on the beach, Mr. Amos also keeps accurate records on local wind, current, tide, and temperature data so as to be able to correlate these factors with the type and amount of debris inventoried. He reviewed the most recent data he had collected from his 1987 weekly counts of natural and manmade items found on the beach. Overall, most items derived from the offshore environment, such as plastic sheeting and rope, show peaks during the spring and fall seasons. Noted exceptions are beverage cans that show a strong peak in the summer, which obviously correlates with public use of the beach, and rubber gloves, that peak in mid-July, which he attributes to the onset of the offshore shrimping season. Although Mr. Amos claims to be an expert at spotting foreign debris, which he estimates constitutes about 10 percent of the total litter load, overwhelmingly the trash on Mustang Island Beach, such as the thousands of one-gallon milk jugs and egg cartons he has inventoried, is of U.S. origin.

One of the more interesting natural items Mr. Amos inventoried is stranded sea turtles. He claims to find 40-60 turtles per year and is currently cooperating with another researcher who does necropsies on turtle finds. He noted only two of the dead turtles in the last year were likely to have died from interaction with marine debris. Interestingly, he has inventoried more dead sea turtles in the last year, when there were few explosive removals of offshore platforms, than in the previous year, when explosive removals were routine.

Mr. Amos' goal is to calibrate the last five years of his estimates by actual counts in hopes of determining increases or decreases in the amount and specific content of the marine litter and beach trash associated with Mustang Island Beach.

Ms. Dianne Lindstedt, a research assistant from the Louisiana Geological Survey, is cooperating with coworker Joe Holmes in compiling and analyzing data on marine debris impacting beaches throughout coastal Louisiana. Ms. Lindstedt provided a report on the preliminary findings from Louisiana's first coastwide beach cleanup resulting from compilation of data submitted by volunteers participating in the September 19, 1987, cleanup and described their quarterly sampling of six Louisiana beaches over the past year. Findings from the State sponsored sampling of six Louisiana beaches were unavailable at the time of this meeting.

The State received about 500 data sheets from the September 19 volunteer cleanup of 16 Louisiana beaches. It was able to use 400 for this analysis and half of these were from two beaches--Grand Isle and Fourchon Beaches in the eastern part of the state. From almost 100,000 pieces of litter recorded, 40 percent was made of plastic and 23 percent of styrofoam. Statewide, 36 percent of all the items collected were drinking containers. The five most common items were styrofoam cups, followed by pieces of styrofoam, plastic cups and lids, 1-gallon milk or water jugs, and plastic bags. Other very common items were plastic pieces, glass and metal pop and beer containers, styrofoam food trays, and rope. Styrofoam cups, the most common items found at beaches throughout the state, are believed to come predominantly from offshore sources such as oil and gas, merchant shipping, or fishing operations. Items collected and believed to be solely from the oil and gas industry include hard hats, write-protect rings, and pipethread protectors. Although items from several foreign countries were noted, only a very small portion of the litter originated in foreign countries. Ms. Lindstedt noted that the proper disposal of everyday food and drink waste by industries and individuals associated with the marine environment would eliminate at least half of the litter found along the Louisiana beaches.

Mr. Mike Liffmann, Assistant Director of the Sea Grant College Program at Louisiana State University, described a new and innovative project initiative designed to foster economic development interest in Louisiana's coastal zone. Mr. Liffmann has organized a multidisciplinary Louisiana Coastal Recreation and Tourism Assessment Team (LCRATAT), which has been conducting a series of rapid, intensive, and low-cost studies designed to provide local interest with guides for the development of recreation and tourism resources.

From experience, personal communication, and limited data, he reviewed the recreational assets, recent use, and limitations of Louisiana's coastal beach developments (Grand Isle, Holly Beach, and Cypremort Point). Sport fishing was identified as the single largest attraction for visitors to the state's beaches. Louisiana officials and local leaders are aware that if they wish to expand public use and development of the state's coastal resources, they must be concerned with the aesthetics of coastal beaches, marshes, waterways, and roadways. It is the consensus of leaders of coastal parishes and communities that (1) there is an urgent need to diversify the region's economic base by reducing dependence on oil and gas and the cyclical fishery industries; (2) their parishes and communities possess the natural and cultural attractions sought by tourists and recreationists; and (3) only a few dollars, technical assistance, and a sense of stewardship are needed in order to convert the tourism development opportunities to a reality.

A major impediment to the realization of coastal recreation and tourism objectives identified by LCRATAT is lack of tourism preparedness. There is currently no tourism development strategy for the state and region beyond publication of promotional material on attractions and events. Mr. Liffmann, through LCRATAT, is encouraging more strategic planning that would concern itself with how a community/parish/region wishes to relate to its environment and, thus, how its resources can best be developed. The state, its regions, and most of its communities have confused strategic and project planning and have embarked on projects in anticipation of, or in reaction to, near-term economic circumstances rather than trying to shape the future through careful analysis and extensive input. Every coastal community must decide (1) whether there is broad-base community interest in tourism development, (2) what community needs could tourism meet, and (3) whether the benefits of such a program outweigh the costs.

Lieutenant Commander (LCDR) Alan Bunn, Assistant Program Manager of the National Oceanographic Atmospheric Administration's (NOAA) Marine Entanglement Research Program, reviewed the program's history, focus, and funding levels. The increasing awareness of the level and persistence of marine debris and its threats to living marine resources, endangered species, and coastal aesthetics led Congress to fund the program in 1985. Program research is categorized into three major areas: (1) education and public awareness, (2) research and impacts assessment, and (3) mitigation. Some of the more important projects of interest to the Gulf of Mexico region, that have been funded, include (1) development and implementation of an educational program for the Gulf of Mexico, (2) beach cleanup information and standards, (3) impacts of plastics on sea turtles, (4) disposal technologies for handling refuse on ships, and (5) investigation of port reception facilities for marine debris. Distributed at the session and available through the Northwest Alaska Fisheries Center in Seattle, Washington, is the report "Descriptions and Status of Tasks in NOAA's Marine Entanglement Research Program for Fiscal Years 1985-1987" by James Coe, program manager, and Alan Bunn (telephone 206/526-4009). This report gives comprehensive descriptions of all the projects supported by the Marine Entanglement Research Program including a note on the status and funding of each, as of July 31, 1987.

The Marine Entanglement Research Program is recognized as one of the leaders in existing studies and information directed at the problem and solutions of synthetic marine debris. Renewed interest and research in a number of alternatives, including recycling, incineration, compaction, recovery, and degradability is a direct result of the new information and awareness stimulated by the program. Plastic manufacturers, fishing organizations, environmental groups, the petroleum industry, and other Federal agencies have been stimulated and/or assisted through this program in furthering the goal of reducing the hazards of marine debris in our oceans. LCDR Runn's presentation concluded with the truism, "If we as a society are going to utilize and benefit from the advanced technology of synthetics, then we must accept the inherent responsibilities of proper disposal."

Mr. Wayne Kewley, representing the Offshore Operators Committee (OOC), an association of 70 companies representing essentially all of the petroleum activity occurring in the Gulf of Mexico, presented a status report on their ongoing campaign to stop offshore littering. Mr. Kewley reviewed the evidence associating the offshore oil and gas industry with the beach trash problem. Industry's major and initial response was development of the educational video, "All Washed Up," reviewed at last year's ITM not long after completion of its production. Subsequently, more than 160 copies have been purchased by 45 member companies of the OOC. Based on an industry survey specifically soliciting information on use of this educational video, which is now a standard part of training and safety programs, it was estimated that 10,500 employees of the oil and gas industry and their contractors have already seen the beach litter movie. Other public and private groups outside the petroleum industry have also acquired the video for their public awareness and education programs targeted at marine debris. The National Park Service put several copies to work as part of the PINS visitor information program. The value of the video as an educational tool was formally recognized last year when the OOC was presented the Department of the Interior's "Take Pride in America" Award for developing and using the video in promoting a sense of stewardship throughout the petroleum industry. Conoco produced a colorful hard hat decal with the slogan "Clean Rigs, Clean Water, Clean Beaches." OOC member companies have purchased over 15,000 decals from Conoco and make it a practice to present one to each employee who views the educational video. The message is now on and, hopefully, in the head of many of the offshore oil and gas workers in the Gulf of Mexico. Several companies have also issued statements on company policies regarding proper waste control and disposal, inserted stipulations in contractual agreements explicitly prohibiting contractors from disposing of solid waste in the marine environment, and developed posters for company bulletin boards. One company has even instituted a ban on the use of styrofoam cups at offshore platfor

The oil and gas industry has also been very visible and responsive in the efforts organized to remove trash and debris from coastal beaches in Texas and Louisiana. They provided manpower, machinery, money, and supplies for these stewardship and data-gathering endeavors. Two companies have even adopted Texas beaches, agreeing to clean them up at least three times a year. Mobil Oil donated most of the bags used in both the Texas and Louisiana cleanups. For Louisiana's first and very successful statewide beach cleanup, the petroleum industry accounted for 25 percent of the sponsorship (19 companies); 10 percent of the volunteers were company employees and their families (over 300); over half the food provided for worker celebration parties, statewide, was donated by oil companies; and most of the heavy equipment used in accessing and removing trash from Louisiana's island beaches was provided by oil companies (7 helicopters, 7 crew boats, and 1 barge).

Institutionally, the offshore petroleum industry manifested a renewed commitment to responsible disposal of solid waste generated offshore, and it has been very responsive to public and private efforts designed to encourage others to share stewardship responsibility for our coastal beaches. Although remnants of pervasive operations from our active offshore industries will likely always be detectable on our coastal beaches, expert opinion and research findings would indicate a substantial reduction in the loss of solid waste from offshore oil and gas operations.

Ms. Kathryn O'Hara, Marine Biologist and Science Advisor for the Washington, D.C. Office of the Center for Environmental Education (CEE), reported on the Gulf of Mexico marine debris education and awareness program they are developing and helping to implement. Noting that persistent marine debris is a national and international issue of increasing public concern throughout the United States, Ms. O'Hara related how the national Congress is increasingly supportive of legal and educational means aimed at reduction and elimination of marine debris, especially plastics.

In 1986, CEE was commissioned by NOAA to develop and distribute special marine debris education materials for the Gulf of Mexico. Educational efforts are currently targeted at groups and industries most closely associated with the problem, namely commercial fishing, merchant shipping, the petroleum industry, the plastics industry, and the general public. Public service advertisements and brochures are being distributed to industry trade journals and through industry associations explaining the problems caused by dumping plastics at sea, with recommendations on how each group can minimize its contributions to the problem. Slide shows, briefing sheets, and video educational products available to the petroleum and commercial fishing industries were viewed at each session. Additionally, CEE has been the lead organization in organizing, coordinating, promoting, and documenting the "Beach Buddy" Texas Coastal Cleanups in 1986 and 1987.

Through these cleanups, the public is made aware of the problems associated with marine debris and is encouraged and provided an opportunity to contribute to the solution. All educational and informational materials and reports on the marine debris developed and distributed by CEE are available through its office in Washington, D.C. (telephone 202/429-5609).

Mr. Frank Morgan, Deputy Commissioner for Land Management from the Texas General Land Office (TLO), described the popular and successful Texas Adopt-A-Beach Program. The program was instituted in 1986 by Land Commissioner Garry Mauro after his participation in the coastal cleanup organized by the CEE convinced him Texas beaches were beset with a garbage problem. Realizing Texans were spending big bucks on beach cleaning ($14 million a year), the Commissioner formed a 55-member Beach Task Force and began recruiting an all volunteer beach cleanup army. The task force is composed of representatives of the petroleum industry, local governments, environmental groups, and civic organizations that formed four very active subcommittees (legislation, education, research and prioritization, and finance), which already are impacting significant legal and attitudinal changes designed to effect long-term waste reduction.

Probably the most visible and successful task force accomplishment is the Adopt-A-Beach program, which relies heavily on volunteers and donations from the private sector. Adopting groups agree to maintain a designated segment of Texas beach for one year and are required to participate in two scheduled and one discretionary cleanup. Mr. Morgan indicated three essential elements for the success of the program: volunteers, county coordinators, and incentives for adopters. Most impressive is the accomplishment of the program to date. In less than a year all of Texas' 172 miles of accessible beach has been adopted by 139 groups. Texas now leads the nation in volunteer support for beach maintenance. Emphasis will now be placed on adopting less accessible beaches, expanding public awareness of the problem and its solution, and educational initiatives targeted at children. In his concluding statements, Mr. Morgan emphasized that state and local efforts and beach adoptions are only short-term remedies for a problem with national and international ramifications. The TLO has shown great leadership in seeking national and international support for legal mandates and in prohibiting the disposal of all solid wastes except foodstuff anywhere in the Gulf of Mexico.

The final presentations of the session consisted of a panel focusing on 1987 Gulf of Mexico beach cleanups. The cleanup coordinators from Texas, Louisiana, and the Gulf Islands National Seashore in Mississippi and Florida presented highlights of their cleanup day events. Impressively, over 10,000 volunteers from throughout Texas and Louisiana volunteered to "Lend a Hand in the Sand" on September 19, 1987, removing trash and litter from more than 200 miles of Gulf of Mexico beaches.

Linda Maraniss, Director of the Gulf States Regional Office of the CEE, reported on the second annual statewide Texas Coastal Cleanup and data collections. CEE has organized, promoted, and coordinated these cleanups primarily to focus attention on the increasing problem of marine debris, especially plastic, and its effect on living marine resources. Over 7,500 volunteer "Beach Buddies" combed 157 miles of Texas coastline for three hours on September 19 removing an estimated 309 tons of marine debris and beach trash. CEE has developed data forms that encourage volunteers to record trash items under the categories of plastic, glass, metal, paper, styrofoam, and wood. They analyze the data, attempt to identify sources, and publish reports on their findings with recommendations aimed at solutions to the problem. The 1987 cleanup produced 1,580 data cards from which preliminary analysis would indicate the litter load was composed of the following: plastic-56 percent, metal-13 percent, glass-11 percent, styrofoam-10 percent, paper-7 percent, and wood-3 percent. Plastic bags and bottles were the most common items recorded. Beverage containers composed 20 percent of the items collected. Their findings are very similar to those resulting from the 1986 Texas Coastal Cleanup. Final analysis will also rate 1987 findings by source in four categories including cargo, galley, operational wastes, and fishing gear. Many foreign items were noted, representing 14 different countries as well as stranded animals including fish, crabs, birds, sea turtles, and marine mammals. The TLO and oil and gas industry are among the major supporters of the Texas Coastal Cleanup.

Mr. Calvin Fair, director of the Louisiana Clean Team, summarized the highlights of the 1987 Louisiana "Sweep of the Beach." He, along with Margie Schoenfeld of the Louisiana Nature and Science Center's Recycle

New Orleans Program, coordinated Louisiana's first statewide beach cleanup. The previous two years they had organized and coordinated a beach cleanup at Grand Isle, Louisiana, as part of National Coastal Week celebrations. Mr. Fair was pleased to report over 3,300 volunteers from over the state picked up nearly 16,000 bags of trash, representing an estimated 200 tons of beach litter and debris from 85 miles of Louisiana beach front. Analysis of the trash load is being carried out by the Louisiana Geological Survey, and preliminary results were discussed previously by Ms. Dianne Lindstedt.

The MMS and the Louisiana Sea Grant College Program were instrumental in planning and organizing the 1987 Louisiana statewide cleanup, that was generously supported by the oil and gas industry with tremendous cooperation from local governments, the Sierra Club, other environmental organizations, civic and church groups, scouts, and private business.

Ms. Gail Bishop, National Park Service Interpreter for the Mississippi District of the Gulf Islands National Seashore, reported on the highlights of cleanup and marine debris education and awareness projects in Mississippi. With a late start, lots of enthusiasm, and valuable support and cooperation from the Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, volunteers and staff were able to mount a marine litter campaign under the slogan "Stash Your Tras=Marine Litter is More than an Eyesore." Coastal newspapers, radio, and television stations were responsive to the campaign, which culminated in volunteer cleanups of several island components of the Gulf Islands National Seashore in Mississippi and Florida in mid-October. Approximately 100 volunteers worked over 700 hours and bagged an estimated 9,500 pounds of beach trash in Mississippi, and 50 volunteers removed 6,000 pounds in Florida. The Park Service provided data forms during these cleanups and determined an order of prevalence: metal cans, plastic bottles, plastic bags, and plastic lids are the major types of litter items impacting their recreational beaches. The Service concluded that the apparent sources of the majority of marine litter include people involved in commercial fishing and recreational boaters who accidentally or deliberately dump trash overboard.

The general concern and distaste for the deleterious effects of marine litter are evident by the increasing public and private response to the awareness campaigns and beach cleanups organized throughout the Gulf Coast region. Continued efforts to encourage public awareness of the problem through beach cleanups can reduce the blight and produce a data-base that will be useful in determining content and trends in beach trash over time and in targeting educational programs. This should continue to aid in identifying sources and effects on living marine resources as well as charting progress, encouraging institutional commitment to resolving the program, and developing individual pride in our coastal and marine resources. Taking the lead from the exceptional accomplishments of the TLO, the MMS Gulf of Mexico OCS Regional Office is the first group to adopt a Louisiana beach in hopes that other groups and states from Brownsville to Key West will do likewise and become part of the solution instead of the problem. The Director of MMS, through his "Take Pride Gulfwide" Task Force is encouraging the leaders of major Gulf industries and their regulators to work together in voluntarily finding and implementing feasible solutions to this problem. We are most pleased to note on page five of the report recently prepared by the CEE for the TLO in support of Special Area Designation for the Gulf of Mexico under MARPOL Annex V that, "It is estimated only 10 to 15 percent (of the marine debris) has come from oil and gas operations, and with the combined efforts of the Texas General Land Office, the U.S. Minerals Management Service, and oil and gas operators themselves, that percentage is being reduced." This report was carried by the U.S. Delegation to the International Maritime Organization meeting in London, England, concurrently with the timing of the Gulf of Mexico ITM. We take pride in our progress and challenge all Gulf industries and states to join our efforts to solve this problem.

Mr. Villere C. Reggio, Jr., is an Outdoor Recreation Planner with the MMS Gulf of Mexico OCS Regional Office. His responsibilities include research, assessment, and reporting on the interrelationship of the OCS oil and gas program with the recreational elements of the marine and coastal environment throughout the Gulf of Mexico region.

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BENTHIC ECOLOGY AND LONG-TERM ENVIRONMENTAL MONITORING

Session: BENTHIC ECOLOGY AND LONG-TERM ENVIRONMENTAL MONITORING

Chair: Dr. Robert M. Rogers

Date: December 1, 1987

Presentation Title	Author/Affiliation
Benthic Ecology and Long-Term Environmental Monitoring: Session Overview	Dr. Robert M. Rogers Minerals Management Service Gulf of Mexico OCS Region
Monitoring Changes in Benthic Communities Adjacent to OCS Oil Production Platforms Off California	Dr. Gary D. Brewer Minerals Management Service Pacific OCS Region
Mississippi/Alabama Marine Ecosystem Program	Dr. James M. Brooks, Dr. Charles P. Giammona, and Dr. Rezneat M. Darnell Texas A&M University
Mississippi/Alabama Marine Ecosystems Study: Biological Aspects	Dr. Rezneat M. Darnell Texas A&M University
Mississippi/Alabama Marine Ecosystems Study: Geological Characterization	Dr. Richard Rezak Texas A&M University
Geological Aspects of Hardbottom Environments on the Inner-Continental Shelf Off Alabama	Dr. W.W. Schroeder, Dr. A.W. Shultz University of Alabama, Dr. P. Fleischer, Mr. K.B. Briggs NORDA and Mr. J.J. Dindo Dauphin Island Sea Lab

Session: BENTHIC ECOLOGY AND LONG-TERM ENVIRONMENTAL MONITORING (cont'd)

Presentation Title	Author/Affiliation
Effects of an Oil Spill on Mangrove, Seagrass, Reef Flat, and Coral Communities on the Caribbean Coast of Panama	Dr. John Cubit, Dr. Jeremy B.C. Jackson, Dr. Karen Burns, Dr. Stephen D. Garrity, Mr. Hector Guzman, Mr. Karl W. Kaufmann, Dr. Anthony H. Knap, Dr. Sally C. Levings, Dr. Michael J. Marshall, Mr. Ricardo C. Thompson, and Mr. Ernesto Weil Smithsonian Tropical Research Institute
Preliminary Results of Recent Investigations on Detection, Chemical Treatment, and Recovery of Open Ocean Oil Spills	Mr. Edward J. Tennyson Minerals Management Service Technology Assessment and Research Branch

Benthic Ecology and Long-Term Environmental Monitoring: Session Overview

Dr. Robert M. Rogers
Minerals Management Service
Gulf of Mexico OCS Region

A large portion of the funding for the MMS Environmental Studies Program is allocated to the monitoring of potential and real effects of OCS activities on marine ecosystems, especially in the more stable benthic environment. Such environmental monitoring is by nature a complex and expensive endeavor. In addition to the variability of the physical environment and the biological processes, there are usually questions as to the limits of detection of the sampling methodologies and analytical instrumentation. This is further complicated by the effects of a variety of human activities. The effects of offshore oil and gas activities may easily be obscured by a great deal of other anthropogenic alterations, such as fisheries, transportation, dredging, etc.

To understand more about long-term environmental variability, the MMS is planning such a long-term study to be initiated this fiscal year. Study objectives will be to occupy sampling sites surveyed during previous MMS marine ecosystem and topographic features studies. Sites will be sampled at least on an annual basis, using sampling or observational methods most appropriate for the site, considering topographic relief, water depth, nature of substrate, and biological communities of concern. Sampling sites will be located in the Gulf of Mexico, generally in areas previously studied by MMS, BLM, or other Federal agencies. This will provide a significant data history for comparison with future observations.

The purpose of this session was to emphasize a number of related marine ecosystem studies presently in progress. Most of these studies are sponsored by MMS and have only recently been initiated. With this in mind, presentations were proposed to emphasize program design and sampling methodologies, rather than final results.

The first presentation of the session was given by Dr. Gary Brewer. The MMS Pacific OCS Office is conducting a multiyear, multidisciplinary program designed to monitor oil production platforms off southern California. This California Monitoring Program (CAMP) is the first attempt to measure potentially subtle, long-term changes in biological communities living in the vicinity of oil production platforms.

Phase 1 of the CAMP study began in 1983 with a reconnaissance of the Santa Maria Basin, an area where some exploratory oil drilling has occurred but no previous oil production activity. The overall objectives are to (1) characterize existing sediment hydrocarbons and trace metal concentrations, (2) identify and map benthic biological assemblages, and (3) identify candidate sites and species, and recommend techniques for long-term monitoring during the subsequent Phase 2 period. Phase 2 monitoring will encompass field sampling and analyses for at least five years (1985-1990). The experience gained during Phase 2 should provide the insight for additional studies during the projected Phase 3 period.

The experimental rationale is to sample all regional and site-specific stations during the fall of each year, both before platform drilling begins and after production is established. Studies will be conducted for the characterization of soft bottoms, hard bottoms, chemistry including hydrocarbons and trace metals, sediment, and physical oceanography.

The comprehensive, multidisciplinary design of CAMP reflects the awareness by MMS that the assessment of environmental impacts that may be associated with oil and gas activities or, indeed, any anthropogenic influence, is limited by our poor understanding of fundamental ecosystem processes.

The next three speakers gave an overview of an MMS Gulf of Mexico OCS Regional Office's sponsored study of the Mississippi/Alabama/Louisiana continental shelf. Drs. James Brooks, Rezneat Darnell, and Richard Rezak of Texas A&M University, respectively, discussed the program organization, biological, and geological aspects of the study.

The primary goal of this study is to environmentally characterize this region of petroleum exploration and development interest. This relatively small area is of great importance to the adjacent state because of heavy demands on natural resources from a variety of user groups, including marine transportation, dredge dumping, and commercial and recreational fishing.

Field sampling from the first year field effort will be designed to characterize dominant processes on the OCS and to provide a basis for further investigations into spatial and temporal variations. Included in this concept will be the analysis of trophic relationships among dominant biological components of the ecosystem and a description of current movement within the study area. On the slope, prominent topographic features shall be located and evaluated as to their biological sensitivity and need for further study.

The study is presently in this first phase of field sampling. In October, the first sampling cruise for biological and chemical parameters was initiated. Field sampling activities include benthic grab sampling for infauna, sediment texture, total organic carbon, hydrocarbons, and trace metals. Trawl samples were taken for fishes and invertebrates and for food habit analyses. At each station, a conductivity/temperature/depth transmissivity continuous profile was performed. Discrete water samples of salinity, dissolved oxygen, and nutrients were collected in the water column.

A reconnaissance survey has been conducted of the offshore pinnacle area utilizing side scan sonar and high resolution subbottom profiling. Features observed during a cursory examination of side scan records include pinnacles, banks, patch reefs, sand waves, and ridges.

Field sampling from the second year will consist of two sampling cruises to characterize the OCS, deployment of current meters to characterize current movements, and a biological reconnaissance of continental slope topographic features. Sampling will be based on information needs identified through the first year field effort with an overall emphasis on special communities and ecological processes.

The third phase of this effort will consist of a final cruise(s) for gathering environmental data needed to fill information gaps and a synthesis of information compiled through the previous two years of field effort. The final synthesis will integrate all aspects of the field study, identifying and displaying significant relationships and processes.

Dr. William Schroeder of the Dauphin Island Sea Lab discussed the geological aspects of hardbottom environments of the inner continental shelf off Alabama and northwest Florida. Since 1984, researchers at the Dauphin Island Sea Lab have undertaken 16 reconnaissance surveys at potential hardbottom sites in this area. In the spring and summer of 1987, scientists from the University of Alabama and the Naval Ocean Research and Development Activity (NORDA), under the auspices of the Mississippi/Alabama Sea Grant Consortium and NORDA, conducted five side scan sonar/subbottom profiling cruises and eight underwater TV video and grab/dredge, ground-truthing cruises in three inner shelf study areas.

The hardbottoms observed consisted of loose accumulations of whole and broken shells and of both reworked and in situ carbonate-cemented sandstones and mudstones. Vertical relief of the hardbottom areas is variable, ranging from almost flat to nearly 2.5 m, in water depths ranging from 10 to 35 m. On a region wide scale, these hardbottoms appear to be distributed along several shore-parallel (west to east) isobaths, suggesting an origin related to Quaternary sea-level changes. However, on smaller spatial scales, the orientation of the features are often observed as being oriented northwest to southeast.

Research will continue in 1988 as a major cooperative project. This will include geological work in both the original study areas and in new study areas, as well as biological work dealing with age and growth rates of selected recreationally important fishes. Additional surveillance is proposed from a submersible platform.

The next speaker was Dr. John Cubit of the Smithsonian Tropical Research Institute (STRI) located in Panama. MMS has funded a study through STRI on the effects of an oil spill on mangroves, seagrasses, reef flats, and coral communities on the Caribbean coast of Panama. Such research results should prove very useful in a management decision related to the potential effects of an oil spill in a tropical region of the United States such as south Florida.

In 1986, 240,000 barrels of medium weight crude oil spilled from a ruptured storage tank on the central Caribbean coast of Panama. A significant amount was washed into a sensitive area of coral reefs, seagrass beds, and mangrove forests, including an STRI biological reserve where previous studies provided baseline information.

Dr. Cubit reported on some of the initial findings of the STRI team of investigators. Generally, seagrasses in subtidal beds were not exposed directly to oil slicks and showed little damage. A detailed study of infaunal and epifaunal populations is being carried out on the seagrass communities. Significant effects were noted on the platforms of fringing reefs forming most of the intertidal habitats. Zoanthids, corals, sea urchins, coralline algae, and other reef edge organisms were directly exposed to oiling during each low tide following the spill. Likewise, red mangroves and their associated biological communities directly exposed to oiling were significantly affected.

Mr. Edward Tennyson of the Technology Assessment and Research Branch of MMS gave the concluding presentation concerning preliminary findings from at-sea experiments on two intentional oil spills in Canadian waters. The tests were conducted to evaluate the following: new chemical additives, shipboard radar as an oil-tracking tool, a prospective standardized test offshore boom performance, and existing capabilities to contain and clean up high paraffin-based crude oils. The first exercise evaluated a Canadian emulsion inhibitor, or "demoussifier," and a visco-elastic agent, "Elastol," in a series of ten 5-barrel oil spills off Nova Scotia. The second exercise was a multiphase field trial based on the use of three containment booms and three types of skimmers. A 20,000-gallon oil spill of Brent crude treated with additional paraffin was released off Newfoundland.

Some preliminary analyses indicated the following:

- Existing ship radar can be effective in tracking oil slicks.
- The immediate use of the product Elastol appears to reduce subsequent containment efforts during mechanical recovery.
- When winds exceed 15 knots, downwind towing is preferred in containment efforts.
- The addition of Elastol in dosages estimated to be below 1,000 ppm enabled relatively rapid recovery with olephilic skimmers.
- The oil slicks of Alberta Sweet Blend Mix and Bunker C were totally dispersed within 36 hours in waves approaching 5 to 8 feet.

Dr. Robert M. Rogers is an oceanographer on the Environmental Studies Staff of the MMS Gulf of Mexico OCS Regional Office. He has served as Contracting Officer's Technical Representative on numerous marine ecosystem studies. Dr. Rogers received his B.S. and M.S. degrees in zoology from Louisiana State University and his Ph.D. in marine biology from Texas A&M University in 1977.

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DEEPWATER DEVELOPMENT AND PLATFORM INSPECTIONS

Session: DEEPWATER DEVELOPMENT AND PLATFORM INSPECTIONS

Chair: Dr. Maurice I. Stewart, Jr., P.E.

Date: December 2, 1987

Presentation	Author/Affiliation
Deepwater Development and Platform Inspections: Session Overview	Dr. Maurice I. Stewart, Jr., P.E. Minerals Management Service Gulf of Mexico OCS Region
Developments in Placid's Green Canyon Block 29 Project	Mr. Antoine Gautreaux, P.E. Placid Oil Company
Jolliet Field Development in Green Canyon Block 184	Mr. Cor Langewis Conoco Oil Company
Shell Green Canyon Block 65, Project "Bullwinkle"	Mr. G.H. Sterling, P.E. Shell Offshore, Inc.
Ocean El Dorado: A Floating Production System	Dr. Terry D. Petty Ocean Drilling & Exploration Co.
Underwater Inspection, Maintenance, and Repair Program of Chevron USA	Mr. Kevin P. Bourgeois, P.E. Chevron USA
Monitoring the Structural Integrity of Offshore Platforms	Mr. Francis P. Dunn, P.E. Shell Oil Company

Deepwater Development and Platform Inspections: Session Overview

Dr. Maurice I. Stewart, Jr., P.E.
Minerals Management Service
Gulf of Mexico OCS Region

Few events have excited the offshore industry interest as have the deepwater oil and gas discoveries recorded recently on Federal OCS tracts in the Gulf of Mexico. Lying underwater from 600 to nearly 7,500 feet (ft) deep, the discoveries are on the slope 30 to 150 miles offshore. Today, operators hold active leases on over five million acres in water depths over 600 ft, and the deep Gulf is considered one of industry's hottest wildcat plays.

There are over 3,600 structures in Federal waters in the Gulf ranging in size and complexity from a simple, single-pile caisson supporting one well to major platforms of considerable structural complexity. Typically, these major platforms are large, multiwell production structures designed for a field life of approximately 20 years.

The offshore engineering session was organized in two distinct parts. In the first part, deepwater drilling and production efforts planned and now underway in the "frontier areas" of the Gulf were summarized. In part two, a summary of current methodologies for inspecting and monitoring the structural integrity of existing platforms was presented.

Since deepwater activity is so widely dispersed throughout the Gulf, Dr. Stewart previewed the session with an extensive overview of both existing and proposed deepwater activities. This set the stage for key deepwater operators to discuss technological and operational challenges that must be overcome to economically develop what may be the most significant U.S. producing area since Prudhoe Bay.

Mr. Antoine Gautreaux, from Placid Oil Company, discussed the development and current status of Placid's 1,500 ft floating production system (FPS) located in Green Canyon Block 29 and its shallow water central processing platform (CPP) in nearby Ship Shoal 207 field in 100 ft of water. The FPS system, designed to support a combination of 24 total template-drilled and satellite wells from surrounding 1,500 to 2,000 ft water, will ultimately establish oil production of 25,000 BOPD (barrels of oil per day) and 120 MMSCFD (million standard cubit feet per day) of natural gas.

The FPS system consists of subsea trees, a subsea template, a production riser, flow lines/pipelines, a semisubmersible drilling/production facility, mooring system, and a shallow water central processing production platform.

To date, one subsea template christmas tree and two satellite well subsea christmas trees have completed factory acceptance testing and are ready for installation. The 24-well subsea template has been fabricated and is installed. A one-mile section of flow line bundle has been constructed, launched, and "bottom towed" to the installation site. One seven-mile section of flow line bundle has been constructed, launched, and "bottom towed" to a temporary "parking" area awaiting final installation.

The Penrod Drilling Company semisubmersible rig 72 is complete with modifications and is moored on location in Green Canyon Block 29, with the production deck section in the field being installed.

Placid's FPS system project clearly demonstrates that major subsea structures can be easily installed with precise positioning in deepwater tracts. Phased installation of the mooring system provided an efficient method of final attachment for permanent installations. Furthermore, the pipeline "bottom tow" procedure provides an effective method of pipeline installation in deepwater applications.

Mr. Cor Langewis, from Conoco, Inc., discussed the development and current status of Conoco's 1,750 ft Green Canyon Block 184 project. Conceptual studies began in 1981 and were refined as exploration and delineation progressed. The concepts studied for field development included conventional fixed jacket platform, guyed tower, tension leg platform (TLP), and a converted semisubmersible with subsea wells.

The tension leg well platform (TLWP) concept was developed and refined in 1984. This concept utilized a small, efficient TLP in the deepwater location to do only those functions that are absolutely required at that site. All other functions would be performed at a second shallow water CPP. Production is scheduled to begin in the last quarter of 1989 at a peak of 35,000 BOPD and 50 MMSCFD.

Detailed design work was initiated in early 1986. The TLWP work was awarded to Lummus Crest/Earl and Wright. The rig design was done by Stress Engineering of Houston. The pipeline work was awarded to Brown and Root. The CPP structure and facilities design is being done by Hudson Engineering (McDermott) of Houston.

The drilling template was installed in June 1987. Batch setting of a 30-inch conductor and a 20-inch surface casing was completed for all 16-inch proposed production wells. Drilling of the first production well started in August 1987, and the third well is currently in progress.

The TLWP will be available for installation in May 1989 when the drilling of production wells is scheduled to be completed. CPP installation and pipeline tie-ins are scheduled to be completed by September 1989 for the start of oil and gas production.

Mr. Gordon Sterling, from Shell Offshore Inc., discussed the status of Shell's 1,353 ft Green Canyon Block 65 "Bullwinkle" project. The 60-slot fixed platform will surpass the height of the tallest existing offshore structure of 1,025 ft. With two drilling rigs operating simultaneously on the platform deck, the entire structure will stand approximately 1,615 ft.

The jacket and deck will be transported and installed by mid-summer 1988. Development drilling will begin in the 1st quarter of 1989 and is scheduled to be completed by the 3rd quarter of 1990. Oil production is expected to peak at 50,000 BOPD in 1991, and natural gas production is expected to peak at 90 MMSCFD in 1992.

Dr. Terry Petty, from Ocean Drilling and Exploration Company (ODECO), discussed the Ocean "El Dorado" FPS. Dr. Petty pointed out that most of the floating production concepts developed thus far rely on the use of subsea systems for production because the large motions of the vessels, principally heave motions, make it impractical to produce conventionally through rigid riser and surface trees.

To overcome this limitation, FPS's with significantly reduced motions such as TLP's and the Ocean El Dorado have been developed. With the reduced motions of these vessels, it becomes feasible to produce conventionally with surface trees on deck, thus avoiding both the capital cost and operating costs of a complex and sometimes inefficient subsea system.

The TLP suppresses heave motion by anchoring the vessel to the seabed with vertical tendons while the El Dorado relies on the hydrodynamic performance of its hull to remain transparent to the seaway.

The Ocean El Dorado design offers the benefit of a semisubmersible hull with significantly reduced motion characteristics, allowing for a more economical and conventional method production. This is combined with a stability/environment criterion consistent with a realistic assessment of the requirements for a deepwater floating production system in the Gulf of Mexico.

Mr. Kevin Bourgeois, from Chevron U.S.A. Inc., discussed Chevron's underwater inspection, maintenances, and repair program. The objectives of Chevron's program are (1) to insure the structural integrity of the platform, (2) to insure the safety of personnel and the environment, (3) to detect and correct detrimental design defects, and (4) to comply with current API/MMS requirements.

To achieve these objectives, Chevron divided its program into two phases. Phase I involves a series of general inspections to determine the present condition of an existing platform and to correct any major defect. Phase II involves a series of detailed and structured inspection tasks to ensure the future structural integrity of the platform.

In order to control a program of this magnitude, automation is essential. Therefore, Chevron developed a computer-aided inspection and reporting system. This system utilizes an inspection database, providing the ability to systematically plan and track the inspection program.

Mr. Pat Dunn, from Shell Oil Company, discussed monitoring the structural integrity of offshore platforms. Mr. Dunn stated that structural monitoring includes any measurement of the behavior, motion, stress, or condition of a platform. He discussed how monitoring is used as an inspection tool in the context of an effective inspection program. Furthermore, he discussed what to do with the results by illustrating a few examples of repair techniques.

Monitoring is also used to gather data about the performance of the platform and about the environment it is in, in order to improve the design of future platforms. Mr. Dunn showed some past measurement programs that have impacted platform design.

Finally, Mr. Dunn expressed that the best defense against future problems is good initial design and construction, along with thorough inspection during construction.

Dr. Stewart is Supervisor of the Technical Assessment Unit for MMS, a Registered Professional Engineer, an author, an inventor, an international lecturer, and an Associate Professor of Petroleum Engineering at Tulane University.

Dr. Stewart's career includes working with a major gas exploration and production company, a marine engineering and construction company, a consulting engineering firm, a university, and a regulatory agency. He has co-authored three engineering textbooks (printed in five languages and used in 183 universities worldwide); he regularly teaches at industry-sponsored short courses and has lectured in 58 countries throughout the world.

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WETLANDS LOSS

Session: WETLANDS LOSS

Chair: Dr. Robert M. Rogers

Date: December 2, 1987

Presentation	Author/Affiliation
Wetlands Loss: Session Overview	Dr. Robert M. Rogers Minerals Management Service Gulf of Mexico OCS Region
OCS Development and Potential Coastal Habitat Alteration: Project Design and Management Overview	Dr. R. Eugene Turner and Dr. Donald R. Cahoon Louisiana State University Center for Wetland Resources
Analysis of Direct Impacts of OCS Pipeline and Navigation Channels on Central Gulf Wetlands	Mr. Robert H. Baumann Louisiana State University Center for Energy Studies and Mr. Andrew R. Reed Louisiana State University Ports and Waterways Institute
Long-Term Salinity Trends in Louisiana Estuaries	Dr. William J. Wiseman, Jr. and Mr. Erick M. Swenson Louisiana State University Center for Wetland Resources
Saltwater Intrusion in Louisiana Coastal Channels	Dr. Flora Chu Wang Louisiana State University Center for Wetland Resources
Saltwater Movement between the Marsh and Adjacent Bayous	Mr. Erick M. Swenson and Dr. William J. Wiseman, Jr. Louisiana State University Center for Wetland Resources
Experimental Field and Greenhouse Verification of the Influence of Salinity Intrusion and Submergence on Marsh Deterioration	Dr. Irving A. Mendelssohn and Ms. Karen L. McKee Louisiana State University Center for Wetland Resources
Inventory of Historical Sediment: Load Records of the Mississippi River	Dr. Richard H. Kesel Louisiana State University Department of Geography and Anthropology

Session: WETLANDS LOSS
(cont'd)

Presentation	Author/Affiliation
Sea Level and Long-Term Subsidence Rates	Dr. Joseph N. Suhayda Louisiana State University Department of Civil Engineering and Dr. R. Eugene Turner Louisiana State University Center for Wetland Resources
Marsh Sediment Accretion Rates in Vicinity of Manmade Canals and Natural Waterways	Dr. Donald R. Cahoon, Dr. Ronald D. DeLaune Louisiana State University Center for Wetland Resources, Dr. Ronald M. Knaus Louisiana State University Nuclear Science Center, and Dr. R. Eugene Turner Louisiana State University Center for Wetland Resources
Results of Landloss Study Based on High Resolution Digital Habitat Data	Mr. Scott Leibowitz Louisiana State University Center for Wetland Resources and Dr. John M. Hill Louisiana State University Department of Civil Engineering
Modeling Wetland Loss in Coastal Louisiana: Geology, Geography, and Human Modifications	Dr. James H. Cowan, Jr. and Dr. R. Eugene Turner Louisiana State University Center for Wetland Resources
Aerial Imagery Interpretation of Relationship between Canal Area and Number of New Ponds	Dr. R. Eugene Turner Louisiana State University Center for Wetland Resources
Studies of Impacts of OCS Activities on Sensitive Coastal Habitats (Barrier Beaches and Non-Louisiana Wetlands)	Dr. Karen M. Wicker Coastal Environments, Inc. and Dr. Donald F. Boesch Louisiana Universities Marine Consortium
Wetlands Mitigation: A Study of Marsh Management	Dr. Chip G. Groat Louisiana Department of Natural Resources

Wetlands Loss: Session Overview

Dr. Robert M. Rogers
Minerals Management Service
Gulf of Mexico OCS Region

The impacts of OCS oil and gas activities related to onshore alterations in the coastal central Gulf of Mexico have been a concern of MMS for a number of years. Study planning was initiated in 1985 to investigate what factors contribute to wetlands loss and specifically what percentage of this loss is due to pipelines, navigation canals, and support facilities located in wetland areas. This "Wetlands Loss" session was organized to provide a forum for the discussion of the most recent findings from these MMS-sponsored investigations.

In September 1985, MMS contracted with the Center for Wetland Resources of Louisiana State University (LSU) to conduct a comprehensive study entitled "OCS Development and Potential Coastal Habitat Alteration." This study has recently been completed with the technical narrative scheduled for distribution in January 1988. Principal investigators from this project reported on significant findings from their individual areas of research and how this related to the overall issue of wetland loss.

Another related project sponsored by MMS is "Impacts of OCS Activities on Sensitive Coastal Habitats." This 2-year contract was awarded to Coastal Environments, Inc. in September 1986. Addressed during this session was progress on the two study aspects: impacts of Federal OCS pipelines on barrier beaches and barrier islands and a reconnaissance level assessment of the impacts of OCS-produced water discharges in coastal wetlands.

A third related wetland project sponsored by MMS is "Wetlands Mitigation: A Study of Marsh Management." This contract was recently awarded as a cooperative agreement to the Louisiana Department of Natural Resources. The study term is two years, beginning in December 1987 and ending in December 1989. An overview of the project was given, stressing the study objective to assess the suitability and feasibility of using marsh management techniques to protect and enhance coastal wetlands and their related resources.

The first speaker was Dr. R. Eugene Turner, who described the structures and goals of the Center for Wetland Resources' (LSU) Wetlands Loss Study. Realizing the different nature of the Louisiana wetlands, the study region was divided into three areas: (1) the Lafourche study area located to the east of Bayou Lafourche, a distributary abandoned by the Mississippi River about 400 years ago; (2) the Terrebonne study area adjacent to the Atchafalaya River, the most recent Mississippi River distributary that today captures 30 percent of the system's flow; and (3) the Cameron study area located in the western part of the state outside of the direct influence of the Mississippi River.

The project was subdivided into two broad analyses: direct impacts and indirect impacts. Direct impacts of OCS-related activities were assessed and compared with the direct impacts of other oil and gas and miscellaneous wetland use activities on coastal wetlands in the study area. Indirect impacts were assessed by investigating how oil- and gas-related activities affect the natural processes controlling wetland loss and by quantifying wetland loss that is indirectly the result of these activities.

The indirect impacts analysis was divided into the following working groups: saltwater intrusion, sedimentation/subsidence, and landscape patterns. The Saltwater Working Group research goals were to identify and quantify the degree and extent of saltwater intrusion with and without canals that contribute indirectly to wetlands loss. The Sedimentation/Subsidence Working Group was to examine accretion processes (e.g., sediment accumulation, peat formation, oxidation, and submergence) as affected by man's alterations. The Landscape Patterns Working Group used remotely sensed data to conduct computer analyses of landloss patterns. These analyses were coupled with statistical analyses to determine relationships between wetland loss and manmade and geomorphic features across the whole coastal zone.

Mr. Robert Baumann discussed the investigation of the Direct Impacts Working Group. Total direct impacts accounted for an estimated 25.6 percent of the total net wetland loss within the Louisiana study area from 1956 to 1978. OCS direct impacts accounted for 4.0 to 4.7 percent of the total Louisiana wetland loss. An important finding was that direct impacts from OCS pipelines averaged 2.49 ha/km and totaled 12,012 ha. Direct impacts are variable and are related to construction technique, geologic region, habitat type, age and diameter of pipeline, and other factors that were not examined.

Navigation channels accounted for a minimum of 16,902 ha of habitat change. Of this total change, 13,615 ha resulted from the loss of wetland and beach habitat. Only a maximum of 17 percent of this change was attributable to OCS activities. OCS traffic appears to comprise a relatively small percentage of the total commercial traffic using navigation channels; thus, the allocation of navigation channel impacts due to OCS activities is small. Direct impacts per unit length of navigation channel averaged 20 times greater than pipelines. The dominant factor controlling the impacts per unit length is the project design.

The Saltwater Working Group presented its findings on the effects of salinity encroachment and its relation to coastal wetland loss. Dr. William Wiseman spoke first on salinity trends in Louisiana estuaries. The database was composed of long-term (up to 44 years) records of salinity collected by the Louisiana Department of Wildlife and Fisheries and the U.S. Army Corps of Engineers (COE). Generally, conclusions were that there were significant trends in salinity statistics over the time period. There was no spatial pattern to the trends. The total change in any salinity statistic was generally small, so small that it was probably not significant to affect local marsh plants; however, in specific locations, the salinity statistic variability was large, and marsh species were indeed affected. The large natural variability observed could have hidden weak trends.

Dr. Flora Wang discussed saltwater intrusion in Louisiana coastal channels. A computer model was developed to describe the movement of salinity related to physical factors. Each of the physical forcing functions--freshwater discharge, tidal exchange, and surface wind stress--played an interactive role on velocity and salinity profiles in coastal channels. Under similar environmental conditions, the saltwater front intruded farther inland for larger and deeper channels than the one in smaller and shallower channels. Dr. Wang also concluded that deepening and widening of a channel does change the nonlinear behavior of saltwater intrusion and patterns of salinity distribution in the channel.

Dr. Erick Swenson discussed the question of how salt migrates to the interior of the marsh—by overland flooding or migration through interstitial waters. To look at this question, intensive sampling of free water salinities in groundwater was conducted over a 3-day period, coupled with subsequent deployment of recording water level and salinity meters.

Based on these data, it appears that the major mechanism for salt transfer into the marsh is occasional overbank flooding with slow return flow. Water in the marsh is also strongly influenced by the precipitation and evapotranspiration. The system is further complicated by the presence of multiple pathways. Variations in wind strength, direction, and spatial scale, as well as stream discharge, may generate small-scale gradients within the open water. These variations are added to the larger scale, predictable gradients associated with tidal flooding. The water level changes of small spatial scale potentially are able to interact with the marsh topography to allow water to enter and flow within marsh channels by a variety of different paths. This means that the source of overbank flooding that drives an observed salinity signal within the marsh may be locally or far-field driven.

Dr. Irving Mendelssohn addressed the question of how, and to what extent, increases in salinity would affect the vegetation of the various marsh types. The major goal of this project was to investigate the effect of increased salinity and submergence on the dominant plant species in each of three marsh types by the simulation of saltwater intrusion and increased inundation under field and greenhouse conditions. Plant species from each of three major habitats were chosen for investigations: *Spartina alterniflora*, salt marsh; *Spartina patens*, brackish marsh; *Panicum hemitomon*, *Sagittaria lancifolia*, and *Leersia oryzoides*, fresh marsh.

Study results showed that the response of marsh vegetation to increases in salinity is influenced by a number of factors, including vegetation type; level, duration, and abruptness of exposure to salinity; and level of inundation. *Spartina alterniflora* was essentially unaffected by increased salinity and slightly affected by waterlogging. *S. patens* was more sensitive to waterlogging and increased salinity. Although fresh marsh plant species were adversely affected by waterlogging and increased salinities, their response may vary according to species. Thus, fresh marshes composed of more tolerant species might be able to survive salinity increases for short periods, but would probably quickly succumb to sudden increased salinities above 10 ppt.

Since the vertical accretion of marshes is dependent on the accumulation of organic matter produced by marsh plants, any reduction in this source will slow the aggradation process. A sudden change, that leads to a rapid biomass reduction or an elimination, would reduce the potential for marsh accretion to keep up with subsidence and/or sea level rise. The stresses associated with increase in flooding depth and duration could ultimately cause plant demise in areas where marsh accretion lags behind increasing water level. Saltwater intrusion, whether natural or man-induced, may accelerate this process in fresh, intermediate, and brackish marshes.

The next presentations were from the Sediment and Subsidence Working Group. Dr. Richard Kesel has looked at the role of sediment contribution from the Mississippi River in maintaining coastal wetlands. Using available databases from the COE and the Mississippi River Commission, he documented historic trends in bed- and suspended-load discharges of the lower River. Data indicate that the suspended load transported to the Gulf of Mexico has decreased since 1850 by approximately 60 percent. Changes in the quantity of bed load transported by the River were difficult to establish. There has been a decided shift in bed sediment storage from point bars to the channel floor, and this shift may allow this material to be more readily transported. Sediment accumulation above New Orleans appears to represent a wedge of sediment that is or will migrate downstream to the delta possibly without being stored. Grain size data indicate that there has been a fining of sediments within both the suspended- and bed-load fractions of the lower River. The loss of this coarse material may be important in maintaining subaerial land surrounding the delta front.

Dr. Joseph Suhayda reported on his work estimating changes in the absolute land and sea levels in coastal Louisiana during the past 50 years. Sea level change data measured by coastal tide gauges were examined to separate absolute sea level rise from subsidence. The rate of absolute sea level rise and the contribution of freshwater runoff were used to adjust tide gauge records. Subsidence rates for the locations studied were Cameron, 6.1 mm/yr; Hackberry, 4.5 mm/yr; Morgan City, 8.5 mm/yr; Eugene Island, 9.4 mm/yr; and Grand Isle, 7.0 mm/yr.

Another way of looking at subsidence was the resurvey of benchmarks made by the National Geodetic Survey in Louisiana. The subsidence rate on the Chenier Plain was about 3 mm/yr since 1955 and about 6 mm/yr on the Lafourche Delta. A line from Raceland to Grand Isle showed an increasing rate from 0 mm/yr at Raceland to 8.8 mm/yr at Grand Isle. The effect of the withdrawal of fluids from petroleum reservoirs on subsidence was determined using a prediction model and oil/gas production data. Fluids withdrawn include crude oil, condensate, casinghead gas, natural gas, and water. The largest subsidence potential was estimated for the Lake Washington Field at 86.1 cm. There were 19 fields with a subsidence potential greater than 10 cm, considered to be a cutoff value for the model being used.

Because field specific data were not available for each site, a second approach to determining subsidence was to consider field production. Using this method for four fields, the volume of crude oil only, per unit area, was computed and subsidence calculated as follows: Lake Pelto, 130 cm; Leeville, 91 cm; Bay St. Elaine, 89 cm; and Golden Meadow, 59 cm. These values do not reflect the withdrawal of gas or formation water, nor do they reflect seepage or pumping of water into the formation.

Dr. Don Cahoon discussed marsh sediment accretion rates in the vicinity of manmade canals versus natural waterways. Both recent and long-term accretion rates were analyzed by three techniques. Recent accretion rates were evaluated by two marker techniques, using inert clay and inert rare earth stable isotopes. Long-term vertical accretion rates were determined by 137 Cs (25 years) and 210 Pb (100 years) analysis of soil cores. Sediment markers were placed in the marsh 50 m behind the natural or manmade levees and along

50 m transects perpendicular to the waterway. Vertical accretion rates obtained by the three-marker techniques were similar. Accretion rates obtained from 210 Pb techniques were, in all cases, less than 137 Cs, indicating either oxidation and compaction of peats or more rapid accretion in recent years.

Results of the field effort indicated that manmade canals sometimes, but not always, influence the distribution of sediment across the marsh surface. For example, at the Lafourche Parish saltmarsh, long canals bisecting the region on an east-west plane appear to have an important impact on sediment deposition and marsh surface stability; however, there was no effect of distance on vertical accretion and density of mineral and organic matter at either the bayou or canal sites in the salt, brackish, and fresh marsh. The natural site in the fresh marsh, however, exhibited the typical "edge effect" by having significantly higher bulk densities at the streamside plots. This effect was not apparent at the pipeline site.

Another finding was that continuity of spoil banks had no apparent influence on sediment deposition in the saline marsh at Lafourche Parish. Also, organic matter accumulation rates (0.02 and 0.05 g/cm/yr) estimated from recent and 25- to 100-year cores were essentially the same for the canal and bayou sites studied. Mineral sediment deposition varied, depending on marsh site and presence of any streamside effect. It equaled or exceeded organic matter accumulation at most sites. Mineral sediment constitutes an increasing fraction of marsh solids nearer the coast where there is greater tidal exchange.

The Landscape Working Group emphasized computer analyses of spatial and temporal wetland loss patterns using remotely sensed data. It also looked at statistical relationships between wetland loss and the manmade and geomorphic features of the whole coastal zone. Mr. Scott Leibowitz discussed his part of the project using a geographic information system (GIS) to define landloss areas; comparing landloss rates by site, habitat type, and change in salinity; and determining whether specific spatial features, e.g., canals and affected landloss rates.

A number of important findings related to specific spatial trends in wetland loss were noted from the GIS analyses. Rates of landloss were consistent with the geology of the site. The lowest rate of loss was at the Terrebonne site, which currently contains an active sediment source (the Atchafalaya River). The Lafourche site, which is bordered by a recently abandoned distributary (Bayou Lafourche), had the highest rate. The Cameron site, in the Chenier Plain, had an intermediate loss rate.

Many of the relationships noted should be subjected to statistical testing due to the complex landscape and the multiple effects obscuring causative factors. For example, it has long been assumed that oil and gas canals could cause landloss by introducing saline water into freshwater regions and, thus, killing the vegetation. Evidence suggests this is not so, at least for the Terrebonne site. Managing this area for saltwater intrusion (e.g., constructing impoundments or emplacing weirs) could actually exacerbate landloss by reducing sediment input. By combining a GIS with spatial statistics, the analyst can test assumptions such as this before a plan is implemented.

Dr. James Cowan discussed the modeling of wetland loss. Interpreting the results of three quantitative analyses (principal component analysis, multiple regression, and cluster analysis), he suggested the following three conclusions:

1. The complex and regional differences in landloss reflect variations in geology and the delta cycles, man-induced changes in hydrology, and land-use changes. Analyses suggest that the most important factors (determined here as canal density, development, and sediment age), correlated with landloss rate changes, vary depending on location and geologic history, and that the coastal zone is not homogeneous with respect to causal factors or their magnitude. These analyses also indicate that each of the causal factors probably contributes to landloss in the whole coastal zone to some degree. However, the data also indicate that the interaction between these factors is locally variable and complex.
2. The relationship between landloss, hydrologic changes, and geology can be described with statistically meaningful results, even though these data are insufficient to precisely quantify the relationship. However, these data support the hypothesis that the indirect impacts of man-induced changes may be as influential as the direct impacts of converting wetlands to open water or modified habitat.
3. Three regions within the Louisiana coastal zone can be defined by using cluster analysis. The moderate (mean=22 percent) wetland loss rates in region 1 are a result of relatively high canal density and developed area in marshes that overlay sediments of moderate age and depth. On the other hand, landloss rates in region 2 are high (mean=36 percent) despite fewer man-induced impacts; the potential for increased landloss due to both direct and indirect effects of man's activities in these areas is high. Conversely, landloss in region 3 (mean=20 percent) is apparently least influenced by man's activity in the coastal zone because of sedimentary geology, even though these areas have experienced significant habitat alterations and direct landloss.

Dr. Turner examined the relationship between canal area and the number of new ponds of different sizes formed in the wetlands. At least five qualitative types of wetland changes were evident in the four different map groupings examined.

New small holes are more numerous than water bodies of the same size. If new small ponds form, it is likely that the less numerous larger ponds will also form. These patterns are consistent with the conclusion that the marsh is literally breaking up internally, rather than eroding at the edge. The relationship between small and larger pond number is less clear as pond size increases. These relationships complicate interpretation of wetland changes at the landscape level, and an analysis of the spatial and temporal distribution of the small new ponds is probably more useful than an analysis of the few larger ponds.

Results from these analyses support the hypothesis that the hydrologic impacts of canals and spoil banks affect wetland-to-water conversion on the scale of kilometers. They are directly related to the majority of wetlands losses in the study area, and their impacts vary regionally, e.g., with sediment compaction rates that increase with increasing sediment deposition layering. Local influences complicate the interpretation, and not all areas are equal. General results agree with the modeling effort in that regional differences of geologic substrate are demonstrated influences on overall regional wetland loss rates.

Dr. Karen Wicker discussed progress on an MMS-sponsored study related to the impacts of OCS activities on sensitive coastal habitats. The objectives of this study are to investigate past impacts and to predict potential future activities of Federal OCS pipelines, facilities, and navigation channels on barrier islands and beaches. As a part of this study, the impact of OCS-produced water discharge in the study area is being investigated. To characterize the impacts of OCS infrastructure on coastal islands, Federal OCS pipelines, facilities, and channels are being identified and researched as to past history. It is anticipated that a synthesis of field data and historical photography will permit a summation of impacts that have resulted for any given set of conditions involving pipeline construction techniques, environmental forms and processes, and other activity in the vicinity of pipelines.

Dr. Donald Boesch of the Louisiana Universities Marine Consortium (LUMCON) reported on his portion of the study, which involves the analysis of produced water impacts in coastal areas. Some 17 facilities discharge OCS-produced waters into Louisiana waters, and most of the discharge comes from a few large facilities in the Mississippi River Delta, Grand Isle, Port Fourchon, and East Timbalier Island regions. This study involves the sampling and analysis of hydrocarbons and trace metals in sediments and organisms, and benthic organisms in water bodies and wetlands in the vicinity of the discharges.

An analysis of produced water effluent sites was undertaken at Grand Isle, Pass Fourchon, and East Timbalier Island. Highest concentrations of petroleum hydrocarbons in the fine-grained bottom sites were found approximately 100 m from the discharge site. Although the more volatile components, e.g., benzene and toluene, were in lower concentrations, a clear contamination signal was apparent up to 1 km from the discharge site. The macrobenthos at the sites exhibiting more contaminated sediments were absent or extremely depauperate, showing an increasing gradient in numbers and diversity with distance from the discharge site.

Dr. C.G. Groat of the Louisiana Department of Natural Resources reported on "Wetlands Mitigation: A Study of Marsh Management." This study contract has recently been awarded and will seek to provide information related to the effectiveness of marsh management. Such traditional management approaches as levees and water control structures either impound or partially impound wetlands, allowing control of water levels and salinity. Although this may enhance the wetlands value, especially for waterfowl and furbearers, its value in wetlands conservation has been questioned. The main objective of the wetlands mitigation study will be to provide an objective assessment of the suitability and feasibility of using marsh management to protect and enhance coastal wetlands and their related renewable resources.

Dr. Robert M. Rogers is a marine biologist on the Environmental Studies Staff of the MMS Gulf of Mexico OCS Regional Office. He has served as Contracting Officer's Technical Representative on a number of wetlands-related studies. Dr. Rogers received his B.S. and M.S. degrees in zoology from Louisiana State University and his Ph.D. in marine biology from Texas A&M University.

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NORTHERN GULF OF MEXICO CONTINENTAL SLOPE PROGRAM

Session: NORTHERN GULF OF MEXICO CONTINENTAL SLOPE PROGRAM

Co-Chairs: Dr. Robert M. Avent
Dr. Benny J. Gallaway

Date: December 2, 1987

Presentation Title	Author/Affiliation
Northern Gulf of Mexico Continental Slope Program: Session Overview	Dr. Robert M. Avent Minerals Management Service Gulf of Mexico OCS Region and Dr. Benny J. Gallaway LGL Ecological Research Associates, Inc.
Northern Gulf of Mexico Continental Slope Study - Scope, Objectives and Approach	Dr. Benny J. Gallaway LGL Ecological Research Associates, Inc.
The Slope Environment as Seen from a Biological Perspective	Dr. Benny J. Gallaway LGL Ecological Research Associates, Inc.
Distribution and Abundance: Patterns of Megafauna	Dr. Benny J. Gallaway and Dr. Willis E. Pequegnat LGL Ecological Research Associates, Inc.
Distribution and Abundance: Patterns of Macrofauna	Dr. Benny J. Gallaway and Mr. Randall L. Howard LGL Ecological Research Associates, Inc.
Distribution and Abundance: Patterns of Meiofauna	Mr. Randall L. Howard LGL Ecological Research Associates, Inc.
Distribution and Chemistry of Chemosynthetic Ecosystems	Dr. James M. Brooks, Dr. Mahlon C. Kennicutt II, and Dr. Robert R. Bidigare Texas A&M University
Fine-Scale Distribution Patterns of Chemosynthetic Organisms	Mr. Ian Rosman, Mr. Gregory S. Boland, LGL Ecological Research Associates, Inc. and Dr. Robert S. Carney Louisiana State University

Session: NORTHERN GULF OF MEXICO CONTINENTAL SLOPE PROGRAM (cont'd)

Presentation Title	Author/Affiliation
Physiology Of And Death Assemblages Formed by Animals at Petroleum Seeps	Dr. Eric N. Powell, Ms. Audrey Morrill, Ms. Susanne McDonald, Mr. Russell Callender, Dr. George Staff, and Mr. David Davies Texas A&M University
Selected Aspects of Chemosynthetic Community Ecology: Issues in the Making	Dr. Robert S. Carney Louisiana State University

Northern Gulf of Mexico Continental Slope Program: Session Overview

Dr. Robert M. Avent
Minerals Management Service
Gulf of Mexico OCS Region
and
Dr. Benny J. Gallaway
LGL Ecological Research
Associates, Inc.

Dr. Avent briefly introduced the program by reiterating the objectives and timing of this four-year study.

In sponsoring this study, the MMS hoped to gain a synoptic, descriptive view of the benthic biota, hydrography, and sediments in the three Gulf of Mexico planning areas. Years 1 and 2 were devoted to five oceanographic cruises and partial analysis of biological, sediment and water samples, and instrumental data. Year 3 was required to complete all sample analyses and produce a quality data set; Year 4, now underway, will produce a final program synthesis report with appropriate statistical analyses, comparisons, and discussions.

The program will give MMS a descriptive overview of the Gulf of Mexico continental slope from 300 to nearly 3,000 m depth at about the time that oil and gas production moves into ever-deeper waters (see the session on Offshore Engineering and Deepwater Production Technology, this volume).

Dr. Benny J. Gallaway next presented a paper on the program's scope, objectives, and approach. His company, LGL Ecological Research Associates, Inc. (LGL), in conjunction with Texas A&M University (TAMU), has conducted the "Northern Gulf of Mexico Continental Slope Study" (NGOMCS) since 1983 to "develop a basic knowledge of the deep Gulf fauna--their environment and ecological processes in advance of extensive petroleum development." The objectives are to

1. provide an environmental and biological background characterization;
2. describe the environment in terms of overlying water masses, bottom water conditions, sedimentary character, and hydrocarbons;
3. describe, over time and space, the composition, distribution and abundance of the benthic biota (meiofauna, macrofauna, and megafauna) and compare the Gulf to other regions;
4. review and synthesize available information on recently discovered chemosynthetic communities;
5. provide a conceptual model of the ecosystems of the continental slope of the northern Gulf of Mexico. This system will be compared to other slope systems; and
6. assess the need for and suggest the types of studies that should be conducted in future program efforts.

Activities during Years 1 and 2 were directed toward field sampling and laboratory sample analysis. Year 3 was dedicated to finishing the sample analysis and compiling data in a usable and interactive format. Work during Year 4 has been dedicated to conducting analyses designed to meet program objectives.

The acquisition of data for meeting the stated objectives occurred over the course of five cruises, all conducted during the first two years of the program.

Dr. Gallaway continued, presenting the program approach and structure to define zonation and habitat variability, with a series of hypotheses to be tested, involving depth, topography, E-W variability, and hydrocarbon contamination. He then described a multistep analytical and statistical program to achieve program goals and presented an overview of "The Slope Environment as Seen from a Biological Perspective."

The Gulf of Mexico is a nearly enclosed basin with moderate depth sills in the Yucatan and Florida Straits, preventing entrance of waters >1,900 m. The physiography of the Gulf was discussed, and major regional features (e.g., canyons, Mississippi cone, Florida escarpment, etc.) were described in turn. Hydrographic data were shown to be remarkably consistent Gulfwide. Sediment distribution showed regional variation, but 55 percent of the stations were silty clay. Sediment hydrocarbon levels were generally low. Of 40 environmental variables, 4 accounted for 61 percent of environmental variability: region/time, depth, altitude, and longitude.

Dr. Gallaway presented a third paper, "Distribution and Abundance: Patterns of Megafauna," coauthored by Dr. Willis E. Pequegnat. Using trawls and benthic photography, LGL described the larger, visible animals--primarily fishes, decapod crustaceans, and echinoderms.

Fish density was markedly higher on the eastern transect and higher in the fall. Abundance peaks appeared at about 600 and 1,200 m, but few were trawled >1,200 m where diversity fell. Invertebrate density was also greater on the eastern transect, but density patterns, unlike those in the fishes, showed some peaks at depth. More species were endemic to the western Gulf than the eastern Gulf as predicted on the basis of circulation patterns.

Mr. Randall L. Howard presented "Distribution and Abundance: Patterns of Macrofauna," coauthored by Dr. Benny J. Gallaway. The macrofauna, here defined as those animals retained on a 0.30 mm sieve, were separated into 1,569 distinguishable taxa representing 18 phyla. Many species were new to science. About 49,000 individuals were collected. Abundance was highest on the central transect, followed by the eastern and western transects. Annual differences were less than regional and seasonal differences. With a few exceptions, macrofaunal abundance declined with increasing depth. Diversity generally decreased from east to west and with increasing depth. Macrofauna density and diversity values show the Gulf to be depauperate compared to the Atlantic Ocean.

Randall L. Howard then described the "Distribution and Abundance: Patterns of Meiofauna." Meiofauna, those forms passing through a 0.30 mm, but retained on 0.063 mm mesh, were generally not identified below major taxon. Nematodes were the most abundant (59 percent of individuals), followed by harpacticoid copepods (18 percent), nauplii (13 percent), polychaete worms (4 percent), ostracods (3 percent), and kinorhynchs (1 percent). But nematodes and harpacticoids each accounted for only 10 percent of the biomass. (Polychaetes made up about half of the total biomass.) Densities ranged from 125 to 1,141 organisms/10 cm^2 with generally higher values on the central transect and decreasing density with increasing depth. Meiofauna were generally about an order of magnitude more numerically abundant than macrofauna, but biomass estimates were similar.

Dr. James M. Brooks presented a paper (coauthored by Drs. Mahlon C.

Kennicutt and Robert R. Bidigare) on the "Distribution and Chemistry of Chemosynthetic Communities." In 1983 in the Green Canyon leasing area, TAMU workers discovered that chemosynthetic animals gain metabolic energy from gasses (mainly H_2S and CH_4) dissolved in aerated seawater. Ten locations between 530 and 2,400 m depth are now known to contain biogenic or thermogenic gas hydrates in sediment cores, and oil and gas seepage is a widespread event in the NGOMCS area. Using both submersibles and surface ships, workers have

1. identified chemosynthetic organisms (tube worms, mussels, and/or clams) at 17 northwestern Gulf of Mexico continental slope sites;
2. discovered that tube worms and clams from these sites do contain chemoautotrophic, bacterial endosymbionts;
3. found a mussel that is the first demonstrated symbiosis between a methanotrophic bacterium and an animal;
4. identified shallow seismic "wipe-out" zones as high probability sites for chemosynthetic ecosystems;
5. shown that oil seepage is associated with all chemosynthetic ecosystems located to date;
6. demonstrated that carbon, nitrogen, and sulphur isotopes can be useful in differentiating heterotrophic, sulfide-based and methane-based ecosystems;
7. identified the transfer of carbon from the chemosynthetic ecosystems to background heterotrophic organisms;
8. discovered 10 gas-hydrate and several active oil seepage locations in the Gulf of Mexico; and
9. determined that shell beds are being produced in and around areas of petroleum seepage.

Dives have been conducted at the hydrocarbon seep communities to refine the description of the distribution and abundance of organisms around the seep sites and to determine the importance of chemosynthesis.

Mr. Ian Rosman presented a paper coauthored by Mr. Greg Boland and Dr. Robert Carney on the "Fine-Scale Distribution Patterns of Chemosynthetic Organisms." Video tape records, sediment cores, and water samples were collected during four dives by the submersible Johnson-Sea-Link from a small diapir located at 560 m depth southwest of Grand Isle, Louisiana (27 degrees 46'N and 91 degrees 30'W). This is the location of a natural oil seep that supports a dense community of chemosynthetic tube worms and mussels.

The percent cover of both tube worm bushes (*Lamellibrachia* sp.) and mussels (?*Bathymodiolus* sp.) were estimated along video transects leading to and from stations where water and/or sediment samples were collected at intervals away from the stations (0 to 7.5 m and 7.5 to 15 m). These estimates were then compared to the values for methane and extractable organic material (EOM) obtained at each site. There was a significant correlation between high concentrations of methane in the water column above the sediment and high densities of mussels within the inner sampled interval, but not a significant correlation between higher densities of tube worms in each direction. Percent cover of tube worms and mussels showed a significant correlation between tube worm density and EOM at the inner distance, not the outer. Mussel densities were not correlated with EOM concentrations.

The distribution of tube worms forms a roughly north-south linear pattern with two nodes of high density, but does not conform to the topography of the diapir.

Dr. Eric Powell presented a variety of data gathered by his TAMU team (five coauthors) on the "Physiology of and Death Assemblages formed by Animals at Petroleum Seeps."

Two distinctive groups of sulfide-dependent animals have been described: (1) macrofauna associated with hydrothermal vent/cold sulfur seeps/petroleum seeps and (2) thiobiotic meiofauna associated with the sulfide system of shallow-water marine sands. These two offer an important contrast in adaptations to, and use of, sulfide. Dr. Powell offered biochemical data (metabolic pathways) to illustrate several examples of sulfide dependency. With the exception of a mussel that harbors methane-oxidizing symbionts, seep species generally have low catalase levels, probably because oxygen is below saturation and light (a potent oxygen-radical producer in seawater) is absent.

Seep sites are of great interest to paleontologists because they are locations where shell material accumulates and is potentially preservable in the fossil record. Shells are accumulating today only very nearshore above storm wave base, and even here, shell beds are rare. Petroleum seeps offer the single important exception in the western Gulf of Mexico. Only here are shell beds being formed, and only here are shell beds apparently being formed by accumulation at the sediment surface, which undergoes gradual burial. Clams show low incidences of abrasion and dissolution, but a high breakage frequency. Mussels, in contrast, have both high breakage and dissolution frequencies, observed as a higher live-to-dead ratio.

TAMU is currently developing a taphofacies model for the Texas shelf and estuarine system. The petroleum seep taphofacies is markedly different from others in the western Gulf.

Dr. Robert S. Carney gave the final presentation of the session: "Selected Aspects of Chemosynthetic Community Ecology: Issues in the Making."

The Louisiana continental slope chemosynthetic communities associated with hydrocarbon seeps are one of a series discoveries of functionally- and taxonomically-related assemblages in the deep sea. All are associated with sources of methane or hydrogen sulfide in an oxygenated environment, but the underlying geological processes vary from site to site. These communities are the focus of intense international research, and many of the questions to be asked in the Gulf of Mexico have already been identified in previous efforts elsewhere:

1. What are the processes whereby seeping hydrocarbons support distinct communities in rather restricted locations?
2. How do the communities persist, and do physical-chemical and biological factors interact on spatial and temporal scales?
3. How do the species reproduce, disperse, and then successfully recruit?

Only in the Gulf are we faced with the question of environmental impact upon a fauna that is uniquely associated with exploitable hydrocarbon reserves. While the three basic questions listed above are extremely important, taken alone, they cannot answer the question of potential impact. Dr. Carney addressed potential impact through two scenarios—the "Robust Community" vs. the "Fine-Tuned Community" alternatives. He argued in favor of the latter, which requires a much better understanding of spatial, temporal, life history, and abiotic patterns. The relatively shallow communities in the northern Gulf, an area geochemically well known, are ideal sites for future research.

Dr. Robert M. Avent has been a biological oceanographer with the Environmental Studies Section of the MMS, Gulf of Mexico OCS Regional Office since 1981. He received his M.S. (1970) and Ph.D. (1973) degrees in oceanography from Florida State University. He serves as Contracting Officer's Technical Representative (COTR), developing the content and scope of regional studies and monitoring study contracts. He has held positions in academia, State Government, private industry, and the Federal Government.

Dr. Benny J. Gallaway is president of LGL Ecological Research Associates, Inc. and an adjunct professor at Texas A&M University. His primary research interests lie in the field of population ecology and behavioral responses of fish to environmental gradients. He is a member of the Reef Fish Scientific and Statistical Committee of the Gulf of Mexico Fishery Management Council. Dr. Gallaway holds a Ph.D. degree from Texas A&M University.

SOUTHWEST FLORIDA SHELF ECOSYSTEMS STUDIES

Session: SOUTHWEST FLORIDA SHELF ECOSYSTEMS STUDIES

Co-Chairs: Dr. Robert M. Avent
Dr. Larry J. Danek

Date: December 2, 1987

Presentation	Author/Affiliation
Southwest Florida Shelf Ecosystems Studies: Session Overview	Dr. Robert M. Avent Minerals Management Service Gulf of Mexico OCS Region and Dr. Larry J. Danek Environmental Science and Engineering, Inc.
Program Objectives and Design	Dr. Larry J. Danek Environmental Science and Engineering, Inc.
Live-Bottom and Soft-Bottom Biota of the Southwest Florida Shelf	Dr. Neal W. Phillips Continental Shelf Associates, Inc.
Physical and Chemical Oceanography of the Southwest Florida Shelf	Dr. Larry J. Danek and Mr. Michael S. Tomlinson Environmental Science and Engineering, Inc.
Benthic Habitats of the Southwest Florida Shelf	Dr. Neal W. Phillips Continental Shelf Associates, Inc.
Dynamic and Biotic Processes as Seen with Time-Lapse Photography	Mr. Michael S. Tomlinson Environmental Science and Engineering, Inc.
Ecosystem Models of Valued Ecosystem Components	Dr. Benny J. Gallaway LGL Ecological Research Associates, Inc.

Southwest Florida Shelf Ecosystems Studies: Session Overview

Dr. Robert M. Avent
Minerals Management Service
Gulf of Mexico OCS Region
and
Dr. Larry J. Danek
Environmental Science and
Engineering, Inc.

Dr. Avent welcomed the audience and gave a brief introduction. This session was the final series of public addresses describing the results of a six-year research program to understand the habitats, biota, and selected ecological processes on the southwest Florida continental shelf. The program was conducted by three prime contractors: Woodward-Clyde Consultants, Inc. (WCC; Years 1 and 2, Year 2 modification); Continental Shelf Associates, Inc. (CSA; Year 3); and Environmental Science and Engineering, Inc. (ESE; Years 4, 5, and 6). Subcontractors included CSA (Years 1, 2, 6); Mote Marine Laboratory (Years 1, 2, and 3); LGL Ecological Research Associates, Inc. (Years 4, 5, and 6); Skidaway Institute of Oceanography (Year 2 modification); and Florida Institute of Oceanography (Years 1 through 5, ship support). Virtually all reports and other deliverables have been received for all years of the study. The program evolved considerably, following the first year's sampling effort, reflecting the state of knowledge and the need to close information gaps.

Dr. Larry Danek presented the first paper, a "Revision of Program Objectives and Design." The objectives of the six-year program were to

1. determine the location and distribution of benthic habitats and associated communities;
2. determine the seasonal structure and density of selected live- and soft-bottom communities;
3. compare community structure of live and soft-bottom fauna and flora to determine the differences and similarities between them and their dependence on substrate type;
4. determine and compare the hydrographic structure of the water column and bottom conditions at selected sites within the study area;
5. determine and compare sedimentary character at selected sites within the study area, and estimate sediment transport;
6. relate differences in biological communities to hydrographic, sedimentary, and geographic variables; and
7. provide information on dynamics of selected live-bottom communities and determine the major factors that influence their development, maturation, stability, and seasonal variability.

The study area is shown in Figure 8.1.

The program began in 1980 with geophysical characterizations (shallow seismic, side-scan sonar, and bathymetric transects), that were used to identify habitats and community types for future station selection and sampling. Seasonal sampling and additions of transects (as needed) continued into Year 5 but were finished, for the most part, in Year 3. Years 4 and 5 were primarily devoted to the study of benthic processes through the deployment of benthic instrumented arrays to observe and measure biotic change, sediment transport, and current regime in selected "live" bottom community types. Year 6 was a data synthesis effort that included conceptual modeling of the effects on 15 "valued ecosystems components."

Dr. Neal Phillips presented a description of "Live-Bottom and Soft-Bottom Biota of the Southwest Florida Shelf." Over the five field years of this study, 26 live-bottom and 29 soft-bottom stations were sampled using conventional net, dredges, and grabs, and by divers. Depths ranged from 10 m to 159 m and sampled all known habitats in the region. At least 1,497 species were collected in dredges and trawls, and 1,121 in grab samples (with some overlap). Infaunal abundance varied from about 1,000 to 1,400 individuals/m^2. Correlations were made between community types and character and environmental conditions (e.g., temperature, light sediment type and thickness, nutrients, and season). Distribution was described for ten community types and six habitats.

Dr. Danek returned to describe the "Physical and Chemical Oceanography of the Southwest Florida Shelf" (co-authored by Mr. Michael S. Tomlinson). In this primarily biological program, all involved recognized the role of abiotic factors that influence the distribution, diversity, and density of biotic communities. The southwest Florida shelf sediments are predominantly calcareous except for a narrow band of quartz sand close to shore. Sand predominates except for a few isolated pockets of carbonate muds to the south. Hard substrate is generally overlaid by a veneer of sand, often quite thin, and exposed rock is uncommon. Sediment resuspension is high during period storms at shallow stations. Little lateral sediment transport was observed. Wave action is variable, with a normal range of 0-5 m. Tides are mixed and weak, usually <0.7 m in height. Currents tend toward the south ~10 to 30 cm/sec, except during Loop Current or eddy intrusion. Energy spectrum and cumulative vector plots were displayed showing current patterns in shallow and moderate depths. Area waters are generally nutrient poor and uncontaminated by man-induced hydrocarbons. Isopleths of nutrients indicate some upwelling at greater depths, which are induced by the Loop Current.

Dr. Neal W. Phillips returned to discuss "Benthic Habitats of the Southwest Florida Shelf." Six major habitats are present on the shelf:

1. High-relief hard bottom.
2. Low-relief exposed or thinly covered hard bottom
3. Thick sand bottom.
4. Coralline algal nodules.
5. Coralline algal pavements.
6. Shell rubble.

Dr. Phillips described the physiography of the area, its ancient reef complexes, and post-pleistocene geological history. He further described the distribution of these habitats, their influence on epifaunal communities, and other controlling factors (light, temperature, and nutrients).

Mr. Michael S. Tomlinson presented a paper, "Dynamic and Biotic Processes as seen with Time-Lapse Photography", which a compilation and interpretation of visual records taken during Years 4 and 5. Time-lapse cameras were affixed upon up to eight instrumental arrays, which were periodically serviced. Eight millimeter film, frames taken one hour apart, recorded numerous biotic and abiotic events over two years. Time-lapse photography provided valuable information on processes that correlated well with current, wave, and sediment resuspension data taken by current meters, wave gages, and sediment collection tubes, respectively. Time-lapse photography also yielded valuable data on fish and turtle abundance, relative abundance, residence times, diel activities, bioturbation, and biofouling rates and succession.

In the final presentation, "Ecosystem Models of Valued Ecosystem Components," Dr. Benny J. Gallaway described activities during the last program year. As a first step, regional-scale community descriptions were developed including evaluation of abiotic factors, biotic associations, and trophic relationships. Key limiting abiotic factors were judged to be light, temperature, and substrate type. Community types were defined in terms of the longer-living sessile organisms and associated fauna. Depth and the four main biological zones were considered.

Community zonation included nearshore (≤ 10 m), inner shelf (10 to 45 m), middle shelf (45 to 100 m), and outer shelf (100 to 200 m). Trophic dynamics were shown for the photic zone (< 45 m) and aphotic zone (≥ 45 m). Impacts of various oil and gas operations were estimated on 15 "valued ecosystem components" (VEC's)--biota of special importance representing protected, economically important, numerous, or especially sensitive species at all trophic levels, and all identified ecosystems across the shelf. This resulted in a summary impact matrix for all VEC's and all effects. Each matrix element estimated impact radius, severity, and likelihood of occurrence.

Dr. Robert M. Avent, has been a biological oceanographer with the Environmental Studies Section of the MMS, Gulf of Mexico OCS Regional Office since 1981. He received his M.S. (1970) and Ph.D. (1973) degrees in oceanography from Florida State University. He serves as Contracting Officer's Technical Representative (COTR , developing the content and scope of regional studies and monitoring study contracts. He has held positions in academia, State Government, private industry, and the Federal government.

Dr. Larry J. Danek received his doctorate in physical oceanography from the University of Michigan. He is currently Vice President in charge of Regional Operations and Senior Oceanographer at Environmental Science and Engineering, Inc. Dr. Danek was Program Manager on the Southwest Florida Shelf Ecosystems Program. He has also served as Program Manager for projects in the Beaufort Sea, U.S. Atlantic coast, Arabian Gulf, and the North Sea.

STATION	YEAR 1	2	3	4	5	STATION	YEAR 1	2	3	4	5
1	●	●				29	●	●		●	●
2	●					30	●				
3	●	●				31		●			
4	●	●				32		●			
5	●	●				33		●			
6	●	●				34		●			
7	●	●			●	35		●			
8	●					36		●		●	●
9	●	●				37		●			
10	●					38		●			
11	●	●				39		●			
12	●	●				40			●		
13	●	●				41			●		
14	●	●				42			●		
15	●	●				43			●	●	
16	●	●				44			●	●	●
17	●					45			●	●	
18	●					46			●	●	
19	●			●		47			●	●	
20	●	●				48			●	●	
21	●	●		●	●	49			●	●	
22	●	●				50			●	●	
23	●	●		●	●	51			●	●	
24	●	●				52			●	●	●
25	●	●				53			●		
26	●					54			●		
27	●					55					●
28	●	●									

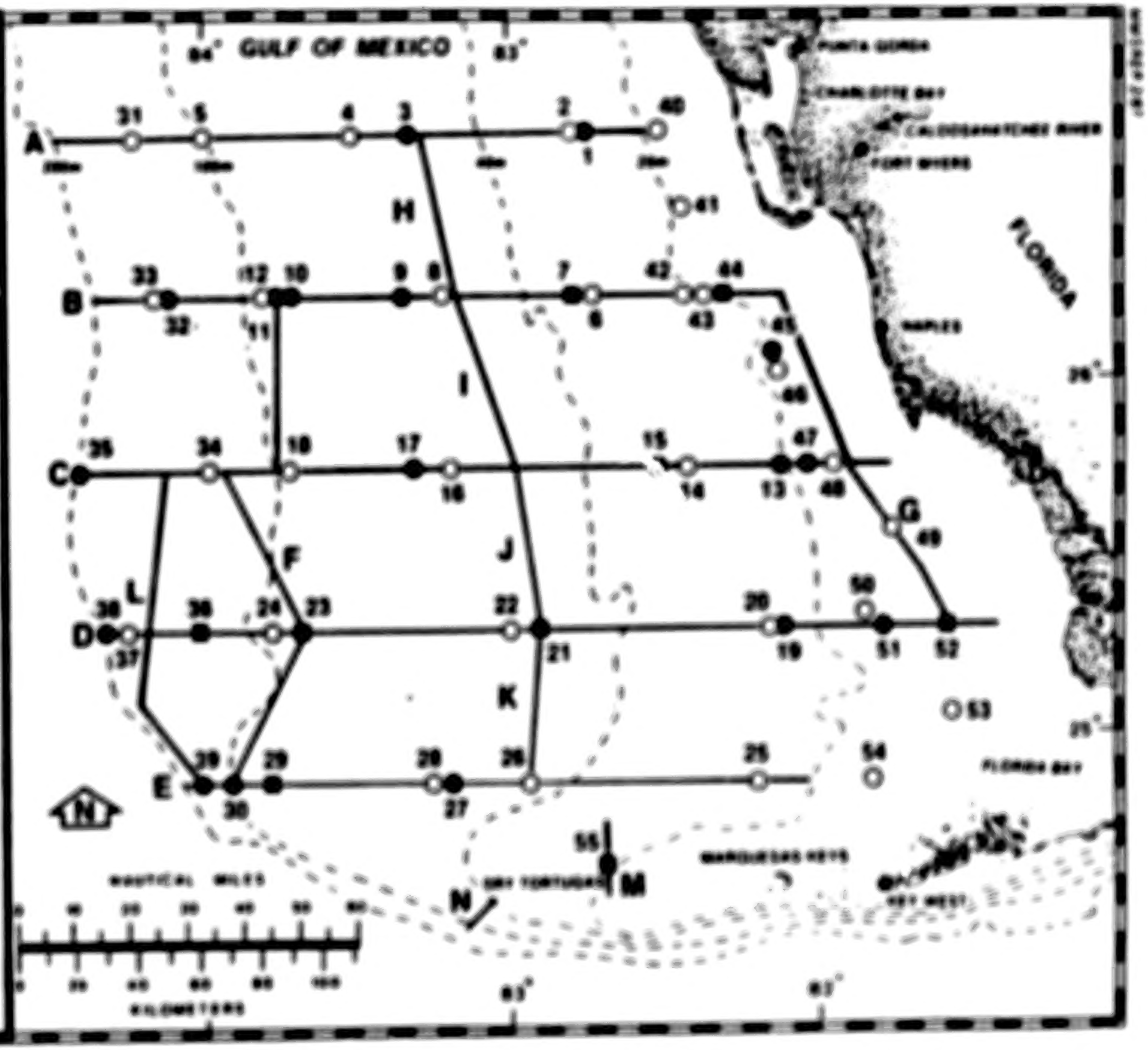

Figure 8.1.-- Southwest Florida Shelf Ecosystems Program study area with Years 1 through 5 geophysical and towed underwater television transects (A-N) and discrete stations (1-55) indicated. Inset indicates years during which stations were sampled; ○ = soft-bottom, ● = live-bottom, and ■ = intensively sampled station.

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MARINE TURTLES AND MAMMALS AND OCS STRUCTURE REMOVALS; OPERATIONAL AND BIOLOGICAL PERSPECTIVES AND STUDIES

Session: MARINE TURTLES AND MAMMALS AND OCS STRUCTURE REMOVALS; OPERATIONAL AND BIOLOGICAL PERSPECTIVES AND STUDIES

Co-Chairs: Mr. G. Ed Richardson
Mr. Lars T. Herbst

Date: December 3, 1987

Presentation Title	Author/Affiliation
Marine Turtles and Mammals and OCS Structure Removals; Operational and Biological Perspectives and Studies: Session Overview	Mr. G. Ed Richardson and Mr. Lars T. Herbst Minerals Management Service Gulf of Mexico OCS Region
Structure Removal: An Offshore Operators Committee Perspective	Dr. Bruce Cox Marathon Oil Company
Nonexplosive Removal Techniques: An Alternate Method of Structure Removal in Environmentally Sensitive Areas (Abrasive Cutter)	Mr. Jack Fernandez, Jr. Dimensional Oilfield Services
Nonexplosive Removal Techniques: Nonexplosive Platform Removal - Hydraulic Pile Cutting	Mr. Leon Ortemond Marcon, Inc.
Louisiana Rigs-to-Reefs Update	Ms. Virginia Van Sickle Louisiana Geological Survey
A Case History for Rigs-to-Reefs: A Cost-Effective Alternative for Platform Abandonment	Mr. Win Thornton and Mr. Jim Quigel Cities Service Oil & Gas Corp.
Analysis of Shockwave Signatures Under Controlled Conditions	Dr. Joseph G. Connor, Jr. Naval Surface Warfare Center
Underwater Sightings of Sea Turtles in the Northern Gulf of Mexico	Mr. Ian Rosman, Mr. Gregory S. Boland, Mr. Larry Martin, and Mr. Charlie Chandler LGL Ecological Research Associates, Inc.
National Marine Fisheries Service Perspective on Structure Removals	Dr. Terry Henwood National Marine Fisheries Service
Perspective on Oil and Gas Production Structure Removals and the Permit Process	Mr. Robert Rosenberg U.S. Army Corps of Engineers New Orleans District

Session: MARINE TURTLES AND MAMMALS AND OCS STRUCTURE REMOVALS; OPERATIONAL AND BIOLOGICAL PERSPECTIVES AND STUDIES (cont'd)

Presentation Title	Author/Affiliation
Use of Seismic Air Guns to Produce Avoidance Responses in Loggerhead Turtles	Dr. James O'Hara Environmental & Chemical Sciences, Inc.

Marine Turtles and Mammals and OCS Structure Removals; Operational and Biological Perspectives and Studies: Session Overview

Mr. G. Ed Richardson
and
Mr. Lars T. Herbst
Minerals Management Service
Gulf of Mexico OCS Region

Two sessions on marine turtles and mammals and OCS structure removals were organized to discuss the operational and biological perspectives of this issue. Several objectives were envisioned for these sessions. The Offshore Operators Committee (OOC), National Marine Fisheries Service (NMFS), and Corps of Engineers were invited to present their perspective on structure removals. Several presentations on nonexplosive removal techniques would be offered as alternative methodologies for explosive removals. An update on the rigs-to-reefs program and a case history of the first rig-to-reef conversion in Louisiana offshore waters were provided information regarding this initiative. Reports of studies involving marine turtles and mammals, their sightings, and their behavior and response to noise were scheduled for the sessions. Finally, methods to reduce the number and/or to eliminate the need for Section 7 consultations under the Endangered Species Act (ESA) were to be discussed during the sessions.

Mr. Lars Herbst opened the proceedings and introduced Mr. G. Ed Richardson as cochair for the morning and afternoon sessions. Mr. Richardson delivered a brief introduction and provided background information regarding the structure removal issue. Mr. Richardson's slides depicted data and statistics from structure-removal applications and observations from structure-removal operations during fiscal year 1987. He also explained requirements under the National Environmental Policy Act for proposed structure removals.

The first presentation of the morning session, "Offshore Operators Committee's Perspective on Structure Removals," was delivered by Dr. Bruce Cox of Marathon Oil Company. The presentation focused on the OOC's position and on recommendations regarding the structure-removal issue. The OOC's position is that if platform removal by use of explosives poses a threat to the survival of an endangered species or even those that are listed as threatened, the offshore industry is willing to take appropriate steps to mitigate the threat. However, the OOC believes the issue and associated mitigating measures have reached far too high a level of attention without any compelling evidence that structure removals pose a threat to the survival of sea turtle populations. Therefore, the following recommendations were offered in the presentations:

1. encourage a research program that places much greater emphasis on the prevalence of sea turtles at structures. These studies should address sea turtle seasonality and distribution as related to structures located along the OCS.
2. encourage MMS and NMFS to prepare a long-range program that outlines research required to determine whether or not explosive salvage operations indeed jeopardize the continuing existence of sea turtles in the Gulf of Mexico.
3. make modifications to the Section 7 consultation process that would reduce the time

required to review and issue removal permits.

4. establish more realistic guidelines for conducting salvage operations.

The next topic of discussion at the session involved nonexplosive techniques for structure removal. The first of the two techniques discussed, the use of a sand jet cutter, and was presented by Mr. Jack Fernandez, Jr., of Dimensional Oilfield. The presentation entitled "An Alternative Method of Structure Removal in Environmentally Sensitive Areas" focused on the equipment required for abrasive cutting. He described the cutter body, which has two tapped side ports that would accept extension arms to size the cutter body to the casing that will be severed. Once the cutter head is made up on the work string and lowered to the cutting depth, the small hydraulic rotary is secured to the work string and to the top of the pipe to be cut. Mr. Fernandez explained that the rotary turns the cutting assembly at about 1 rpm. The cutting time is dependent primarily on the number of casing strings to be cut, the eccentricity of the casing strings, and whether or not the annuli are grouted. The abrasive of choice for Dimensional Oilfield was described as granulated coal slag. Mr. Fernandez mentioned that Dimensional Oilfield has developed a test cell in which particle size, orifice size, and viscosity of the fluid will be examined to produce optimum cutting conditions.

The next presentation was scheduled to discuss the merits of cryogenic fracturing. However, the representative from Offshore Pipeline, Inc., was unable to attend.

The third presentation was delivered by Mr. Leon Ortemond of Marcon, Inc. The presentation included a slide demonstration of equipment utilized in a mechanical cutting operation. The basic equipment list included a pump, a 100-barrel tank, a power unit, a power swivel, and a stabilized work string with the mechanical cutter. The mechanical cutter was described as a multi-blade assembly with carbide tips. The initial rig-up time was stated to be 6 hours, but required only a matter of minutes to move from one pile to the next. A derrick barge or crane would be required to move the assembly from pile to pile. Mr. Ortemond explained that a 16-degree batter pile was successfully cut in Marcon's test facility to demonstrate the ability to centralize the cutter. However, the effectiveness of the cutter to sever well conductors with non-concentric casing strings was not proven.

The fourth presentation, a Louisiana "Rigs-to-Reefs Update," was given by Ms. Virginia Van Sickle of the Louisiana Geological Survey. This presentation was an update to the "Louisiana Artificial Reef Initiative" presentation made by Ms. Van Sickle at the Seventh Annual Gulf of Mexico Information Transfer Meeting (ITM) last year. This year's update focused on the phases of developing the Louisiana Reef Plan. The first phase of the Plan's development was called "exclusion mapping," which eliminated all navigation fairways, military zones, EPA dump sites, live bottoms, and coral reefs. The next phase included the selection of areas that would be considered as high priority for reef development. This selection was accomplished through discussions with the shrimping and fishing industries as well as sport fishing interests. After public hearings were conducted, eight offshore sites were established. The Plan was completed in June 1987, and implementation was initiated when Cities Service Oil and Gas Corporation donated the first reef structure in October 1987.

The morning's final presentation was provided by Cities Service Oil and Gas Corporation and was entitled "A Case History for Rigs-to-Reefs: A Cost Effective Alternative for Platform Abandonment." The presentation was made by Mr. Jim Quigel and Mr. Win Thornton, who discussed both permitting and operational planning for the toppling of the South Marsh Island Block 146 "A" platform. For the permitting procedures, Mr. Quigel explained Cities Services' part in the deed of donation, the site clearance departure, and the endangered species consultation. Next, the actual steps involved in the toppling operation were discussed by Mr. Thornton. The toppling operation closely followed the extensive engineering studies and was deemed a success by Cities Service. The presentation also explained some difficulties Cities Service encountered in following the "incidental take statement" requirements from the endangered species consultation.

The morning session was closed by Mr. Lars Herbst with an explanation of the study to be conducted by the Naval Surface Warfare Center (NSWC) through an Interagency Agreement. The discussion was not presented by the NSWC because of a work conflict. However, an abstract was provided after the ITM that discussed the project. This abstract has been included in the meeting proceedings.

The afternoon session was opened by Mr. Richardson and began with Mr. Ian Rosman's presentation of the underwater sighting of sea turtles in the northern Gulf of Mexico. Data from eight scientific studies in the northern Gulf of Mexico from 1975 to 1985 were reviewed for underwater sightings of sea turtles. This effort yielded 268 verifiable underwater sightings of which 231 came from time-lapse cameras on live-bottom areas off southwest Florida. The majority of sightings were loggerheads. Time-lapse results indicated a distinct diel pattern with more than three times the number of sightings per hour observed during the night. Utilization of underwater structures consisted of brief periods (1 to 5 h) of relative inactivity. Mr. Rosman reached the following conclusions:

1. Underwater sightings of sea turtles by divers were uncommon.
2. Sightings were least frequent during task-oriented dives in turbid water.
3. Time-lapse observations were more effective than dive-observations for determining frequency of occupation at artificial structures.
4. Turtles were repeatedly observed to occupy small artificial structures in southwest Florida waters.
5. Occupation included protracted physical contact with the structure.
6. Occupation occurred more frequently during darkness than daylight.
7. Frequency of occupation possibly increased linearly as a structure remained in place underwater.

Dr. Terry Henwood provided the NMFS perspective on structure removals. He briefly outlined the history of the structure removal and sea turtle issue. Dr. Henwood explained the role of NMFS in ESA consultations. The NMFS is responsible for administering the ESA for all Federal actions that may impact or jeopardize the continued existence of endangered and threatened species at sea. The NMFS performs strictly an advisory function under Section 7 of the ESA.

For all consultations to date regarding structure removals utilizing explosives, the NMFS has concluded that the removals do not constitute a "jeopardy" situation, but may affect listed species. An "Incidental Take Statement" including mitigative measures has accompanied the Biological Opinions for incorporation in the specific removal plans of the applicant.

Dr. Henwood also explained the NMFS responsibilities for administering the Marine Mammal Protection Act (MMPA). The NMFS does not consider injury or death of marine mammals to be likely for explosive structure removals if the operator adheres to the mitigative requirements provided in the ESA "Incidental Take Statement." However, to be in compliance with the MMPA, operators must apply for a permit and be granted a small take Letter of Authorization.

The NMFS offered the following suggestions regarding future structure-removal consultations. Data should be collected to determine when, where, and how many listed species are associated with offshore structures. How many animals are injured or killed as a result of the underwater detonations? Second, he suggested that devices or techniques to "drive" marine turtles and mammals away from structures prior to detonation of explosives should be investigated and developed. Third, the NMFS strongly recommended that industry take an active role in supporting the development of new, nonlethal techniques for structure removals. Industry should also consider data collection to document that some explosive charge techniques presently in use produce minimal blast effects and have little or no impact on marine life in the area of operations.

Mr. Robert Rosenberg presented the New Orleans District (NOD) Corps of Engineers (COE) perspective on structure removals and the permit process. Oil and gas production facilities in tidal bays, estuaries, and within the three-nautical mile zone off the Louisiana coast are under the jurisdiction of the NOD. As those structures cease to be productive, the terms of the State lease agreements, the general conditions of the applicable Section 10 Federal permit (River and Harbor Act) issued by the COE, and economic considerations collectively motivate an operator to remove the obsolete structures as soon as practicable.

When the MMS determined that explosive structure removals constituted a "may effect" situation under Section 7 of the ESA, structures to be removed under the COE's jurisdiction were also affected. The NMFS requested that the NOD of the COE initiate consultations pursuant to Section 7 of the ESA for explosive structure removals. The NOD issued a special public notice directing permit holders to notify the COE before an explosive removal was conducted. The notice further instructed permittees not to proceed until specific notification had been provided. The NOD developed and sent a questionnaire to each of the 15 operators proposing to remove structures. The questionnaire asked precisely why the permittee had to use explosives and what other alternatives were considered. Eleven of the fifteen operators opted for a nonexplosive removal method. The NMFS has concurred with the NOD that nonexplosive removal techniques are not a "may effect" situation and do not require Section 7 consultations. These operators have received permission to conduct their proposed operations.

For explosive removals, the NOD prepares specific biological assessments or, as an alternative, the operator may assemble a specific biological assessment while coordinating with the NOD and NMFS. That assessment could be submitted to the NOD with an explosive removal request and could be subsequently adopted by the COE and submitted to the NMFS for Section 7 consultation.

Mr. Rosenberg also mentioned the need for operators to contact the NMFS and acquire a permit to "take" marine mammals if their proposed activities may involve these animals.

Dr. James O'Hara presented his findings from a study that used seismic air guns to produce avoidance responses in loggerhead turtles. His research was conducted at an electric power plant in Florida utilizing a 300 m dead-end canal from the plant's cooling canal grid. The test canal was isolated by a net at the open end and seismic air guns were arrayed across the canal to establish a sound barrier. A series of subadult turtles were used over several thousand hours of testing in the canal. By using multiple air guns with an air pressure of 2,000 psi firing at a 4/min rate, an effective barrier was established. A statistically significant reduction in occurrence or the movement of turtles into the protected (sound barrier) area of the canal was demonstrated.

Based on the investigations conducted in the canal, Dr. O'Hara believes this technology is transferable to structure-removal operations for offshore platforms in the Gulf of Mexico. He suggests "radio tagging" a sea turtle associated with a structure, monitoring his behavior around the structure for several days, then slowly bringing up the air pressure firing air guns suspended from the structure, and continuing to monitor the movement of the turtle. If the turtle leaves the vicinity of the structure, it would be a clear indication that the methodology is effective.

Dr. O'Hara stated that there is no experimental evidence to indicate that marine mammals would be effectively frightened away from a sound source as the sea turtles had been. However, during the course of the test in the canal with the sea turtles, divers expressed significant discomfort and did not try to approach the sound sources. It is suggested that marine mammals would have a similar response in behavior.

Mr. G. Ed Richardson is a Supervisory Environmental Protection Specialist with the MMS, Gulf of Mexico OCS Regional Office. He has 15 years experience with State and Federal Governments and with the oil and gas industry. Mr. Richardson received his M.S. from Clemson University in microbiology, environmental health, and biochemistry.

Mr. Lars Herbst is employed as a petroleum engineer in the Technical Assessment and Operations Support Section of the MMS. He was previously employed by Flopetrol-Johnston Schlumberger as a field engineer in production testing. He received his B.S. in petroleum engineering from Louisiana State University.

GULF COAST SOCIO-CULTURAL STUDIES

Session: GULF COAST SOCIO-CULTURAL STUDIES

Co-Chairs: Dr. Brent W. Smith
Mr. William T. Johnstone

Date: December 3, 1987

Presentation Title	Author/Affiliation
Gulf Coast Socio-Cultural Studies: Session Overview	Dr. Brent W. Smith and Mr. William T. Johnstone Minerals Management Service Gulf of Mexico OCS Region
Cultural Conservation on the Gulf Coast	Dr. Nicholas R. Spitzer Smithsonian Institution
National Park Service Ethnographic Studies, An Overview	Mr. C. Ray Brassieur Jean Lafitte National Historical Park
Current Research on Asian-Americans on the Gulf Coast	Dr. Jesse W. Nash Loyola University
Undocumented Central American Project: Houston	Dr. Nestor P. Rodriguez University of Houston
Current Research on Hispanics of the Eastern Gulf Coast	Dr. Miguel A. Bretos Florida International University
Current Research in Ethnic Diversity in Coastal Louisiana	Dr. Donald W. Davis Nicholls State University
Current Research on Gulf Coast Indians	Dr. John H. Peterson Mississippi State University
Current Research on Cajun Culture	Dr. Barry J. Ancelet University of Southwestern Louisiana
Socioeconomic Impacts of Offshore Oil and Gas Activities on the Gulf Coast	Dr. Robert Gramling University of Southwestern Louisiana
Adequacy of Available Information on Socio-Cultural Groups and Causes of Recent Socio-Cultural Change in the Gulf Coast	Open Discussion

Gulf Coast Socio-Cultural Studies: Session Overview

Dr. Brent W. Smith
and
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Minerals Management Service
Gulf of Mexico OCS Region

Archaeologists and historic preservationists talk about "cultural resource management." As they define the term, however, almost the entire emphasis is on historic and prehistoric resources, rather than on living people or contemporary cultures and subcultures. The use of the term "socio-cultural" in these sessions relates only to contemporary cultures or those that existed in the recent past.

The Gulf Coast is a region of heterogeneous cultures and subcultures. These groups have been the subject of study by anthropologists, sociologists, folklorists, cultural geographers, historians, and other social scientists. The purpose of these sessions was to characterize the current status of major socio-cultural groups in the Gulf Coast, to discuss current research on these groups and the adequacy of available information, and to identify the causes of recent socio-cultural change, particularly the effects of offshore oil and gas activities.

The first speaker, Dr. Nicholas Spitzer, folklorist with the Smithsonian Institution, discussed the Gulf Coast as a culture region and the role of public agencies in cultural conservation.

The Gulf Coast is a culturally heterogeneous folk region of the United States that has characteristics of both the American South and the Caribbean. Creolization--the interpenetration and syncretism of Afro-European-Native American cultural products, patterns, and processes--is found in Caribbean and Gulf Coast language, architecture, foodways, music/dance, religion, and festival traditions. Thus, it is important to be aware of living cultural resources on the Gulf Coast such as French Creole and *Isleno* Spanish; shotgun houses and Creole cottages; *congri* and gumbo; jazz, Cajun music, and zydeco; Spiritualist religion, voodoo, and folk Catholicism; and Mardi Gras, *Toussaint*, and fleet blessings, among many others.

Material preservation alone, though attractive and consistent with natural science views of cultures as discrete, bounded entities, does not fully address the concerns for culture as a symbolic process where a sense of ethnicity and tradition are continually recreated. This view of culture as a dynamic process and tradition, as being contemporary rather than strictly historical concerns, has profound implications for how we view cultural resource management on the Gulf Coast. We must move beyond viewing cultural resources as exclusively material and historical in nature. Yet, how we deal with the intangible aspects of living culture in a region characterized by such diversity cannot be answered with a simple formula.

Public agencies must work with folklorists and anthropologists to engage in direct dialogues with ethnic/regional community tradition-bearers and folk artists and practitioners on how their resources should be represented. Our efforts at cultural conservation can only be realized through ongoing and multiple cultural *conversations* with the groups who make the region identifiable on the cultural landscape of North America.

Dr. Spitzer provided the following specific recommendations for cultural conservation work and mitigation policies: (1) redefine "cultural resource" to include the traditional social processes, cultural patterns, and material products of contemporary, tribal, ethnic, regional, and occupational groups; (2) make such living traditional cultural resources a significant part of all major areal studies undertaken by MMS; (3) support ethnographic study and cultural mapping of the entire Gulf Coast (similar to efforts by the State of Louisiana and the National Park Service in Louisiana) to the same degree that the natural resources have been mapped; and (4) base future mitigation and cultural conservation efforts on data provided by ethnographic work at three levels--a broad regional cultural survey, particular ethnic and occupational groups in subregional locations, and selected local, model, cultural ecological situations.

The second speaker was Mr. C. Ray Brassieur, a folklorist with the Jean Lafitte National Historical Park, National Park Service. Mr. Brassieur presented an overview of the ethnographic studies that have been sponsored by the Jean Lafitte National Historical Park.

Jean Lafitte National Historical Park and preserve was established November 10, 1978, by Public Laws 95-625 with the purpose of conserving and publicly presenting the natural and historical resources of the Mississippi Delta region and "to provide for their interpretation in such a manner as to portray the development of cultural diversity." In order to uncover the facts pertaining to "the development of cultural diversity," a baseline research effort, entitled the "Mississippi Delta Ethnographic Overview," was compiled under the editorship of folklorist Nicholas Spitzer. This effort described and interpreted man/land relationships, intra/intercultural relationships, and the historical and contemporary significance of the many cultural groups found within the Mississippi Delta region through the perspective of anthropology, cultural geography, history, folkloristics, linguistics, ecology, ethnic studies, and regional studies.

Since the compilation of the "Mississippi Delta Ethnographic Overview" in 1979, twenty reports containing substantial ethnographic or ethnohistorical data have been submitted to Jean Lafitte National Historical Park. Many of the reports focus upon certain aspects of specific ethnic groups: Louisiana Indian tribes, the Canary Islanders, Filipinos, Creoles, and Cajuns, for example. Several of the reports have primarily historical perspectives such as colonial Caribbean culture exchange or nineteenth century Creole life. Still other reports, such as the ones concerning vernacular architecture and New Orleans gospel quartets, focus upon more specific, yet salient cultural themes.

Mr. Brassieur recommended future ethnographic/ethnohistorical work, including (1) continued focus upon ethnic groups, (2) oral history projects directed toward the collection of folk environmental perspectives gathered from elders of the Delta region, and (3) documentation of a maritime heritage, which continues to recede along with the Louisiana coast. In addition to these recommendations, the author posed the following questions concerning the ethics of cultural resource policies directed toward living groups and extant belief and behavioral systems: (1) How do you mitigate the loss of ethnicity?; (2) How can you advocate cultural conservation without affecting the groups involved?; and (3) What happens when cultural conservation goals contrast with public development goals?

The third paper was prepared by Dr. Jesse Nash, Assistant Professor of Religious Studies at Loyola University and Director of the English Language Program for Vietnamese students at Notre Dame Seminary. The paper was delivered by Dr. Brent Smith. Dr. Nash's paper concerned current research on Asian-Americans on the Gulf Coast, focusing on his own research with the Vietnamese. The Asian-American population is growing in the Gulf Coast region, but the size of the Asian communities does not adequately reflect their contribution or visibility. The Asian communities are involved in the restaurant business, the fishing industry, the growing professional class, and education. The Chinese community has been established for some time, but many of the southeast Asian refugees and the south Asian professionals are relatively recent arrivals.

The Vietnamese are perhaps the most visible and can possibly become a political reality to be reckoned with in the future. They have been the most studied of the Asian ethnic groups. Dr. Nash's own research with the Vietnamese of New Orleans has been of the community study variety and is the result of some four years of field work in the community. Vietnamese visibility is itself a phenomenon in the region, partly explained by the size of the population but mostly by its "cultural vitality." The Vietnamese have created communities, both in the geographical and symbolic senses. The vitality of the community in New Orleans, in particular, is explained by its communal structures, maintenance of traditional values and attitudes, religiosity, reputation for hard work, and ability to live with creative tension. Conflicts within the community have not destabilized it so much as made it more vibrant and healthy. Those conflicts center on the relative role of the English and Vietnamese languages in the life of the community, the role of women in terms of education and careers, and ethnic identity. In a real sense, these conflicts face all Asian populations in the Gulf Coast region. They are also united by a common concern for the future of education and employment in the region.

The fourth speaker was Dr. Nestor Rodriguez, Assistant Professor of Sociology at the University of Houston, who discussed current research concerning Hispanics on the western Gulf Coast. Dr. Rodriguez focused on his own research relative to undocumented Central American populations in Houston, Texas, comparing conditions of work and settlement in different parts of the city. Houston ranks second in the United States (Los Angeles is first) in the number of undocumented Hispanics (50,000-100,000).

The study's investigation focused on a variety of social activities, housing, work place and community intergroup interaction, organizational participation in the community, health, employment in the country of origin, reasons for emigrating, experiences with political conflict, conditions during the journey to the United States, and U.S. education of the children.

Completed interviews consist of three major national categories--Salvadorans, Hondurans, and Guatemalans--and also included Nicaraguans, Belizeans, Costa Ricans, and Panamanians. The groups are diverse, reflecting differing racial, ethnic, and linguistic backgrounds. Among these groups are speakers of the Garifuna language, Black Caribs who intermixed with indigenous

Hondurans. Undocumented Central Americans differ from the usual profile of the undocumented Mexican migrant. For example, 45 percent of the sample is older than 29 years of age, and the majority of the sample are, or have been, married. This contrasts with the usual findings of undocumented Mexican migrants as young and single. According to Dr. Rodriguez, further research is needed to understand the incorporation of undocumented Central American immigrants in U.S. society, especially in the context of the new immigration law.

The fifth speaker was Dr. Miguel Bretos, Director of the Cuban Exile History and Archives Project at Florida International University, who spoke on current research on Hispanics on the eastern Gulf Coast. Florida Hispanics are becoming increasingly aware of, and sensitive to, their long history within the region. While Florida had very important connections to Spain during the colonial period, it had even closer connections to Cuba, from where the Spanish adminstration of the Florida colony was exercised for most of the period. This is a matter of some importance, considering that Cubans are, by far, the single largest Hispanic group within the state.

Florida's Hispanics are located primarily in four cities: Saint Augustine, which was the capital of the Spanish colony; Tampa; Key West; and Miami. A very significant influx of Cuban and Spanish immigrants took place in Key West, especially, during the last quarter of the nineteenth century, where their descendants are still to be found. In Miami and Dade County a massive Hispanic, especially Cuban presence, has become one of the fundamental facts of life since 1959. Miami is the "capital" of approximately one million Cuban-Americans dispersed throughout the nation, of whom three-quarters of a million live in Dade County. Other immigrant groups, including Columbians, Venezuelans, Mexicans, and Nicaraguans, live in Dade County.

The demography and socio-cultural dynamics of the Cuban community have received considerable attention. Unlike groups of other recent immigrants, females and the elderly are disproportionately represented among the Cubans, and there is a high proportion of "three-generation" families. It is also known that Cuban women are more likely to be working outside the home than any other Hispanic women.

The Cuban community in South Florida is a true ethnic enclave. In other words, a south Florida Cuban may be born, live, and die entirely within the confines of his culture and language. This has significant economic implications and ensures the continuing vitality of the Spanish language. By the same token, the presence of the enclave may retard the process of assimilation since it is not imperative to learn the language and culture of the dominant society.

The sixth speaker was Dr. Donald Davis, Distinguished Professor of Geography at Nicholls State University, who spoke on current research in ethnic diversity in coastal Louisiana. One impetus for early colonization of Louisiana was its primary base of renewable and nonrenewable resources. Consequently, a range of cultures and settlements is part of the coastal lowlands, making coastal Louisiana one of the nation's "melting pots."

Dr. Davis identified a heterogeneous ethnic mix in Louisiana, including Spanish, French, Italian, Yugoslavian, Irish, German, Cuban, Greek, Latin American, Islenos (Canary Islanders), Vietnamese, Chinese, English, Filipino, Syrian, Lebanese, and Jewish immigrants. Its biggest and oldest ethnic group is of French descent. Many were Acadians (Cajuns) who adopted a fishing/hunting/trapping/agriculture existence.

Spanish ownership of Louisiana did not lead to adoption of the Spanish language or culture (with the exception of the Islenos). The architecture of the French Quarter is a reminder of the Spanish Period. The French Quarter has been described as discovered by French explorers, built by Spanish pioneers, and owned by Italian businessmen--another indicator of south Louisiana's ethnic diversity.

The historical evolution of ethnic-related studies has been conducted by anthropologists, folklorists, geographers, historians, sociologists, and others. These disciplines prepared the foundation for work in material and nonmaterial culture elements and various socio-economic components of each individual culture group. The French culture hearth was the focus of scholarly interest; research has been conducted in language, folk and vernacular house types, French, German, and plantation settlement patterns, boats, swamp culture, music, folk medicine, cemeteries, and foodways.

According to Dr. Davis, there is a need for contemporary research on French Louisiana, including the province's ethnicity, as it relates to changes in rural-small town businesses, type of employment, farming practices, and urban business activities. Also, no research has been conducted on the ethnology, ethnography, ethnicity, or ethnic geography of the Greeks, Jews, Hungarians, Syrians, Lebanese, or Chinese.

The seventh speaker was Dr. John Peterson, Coordinator of Anthropology and Director of the Cobb Institute of Archaeology at Mississippi State University, who spoke on current research on Gulf Coast Indians. The Indians of the Gulf Coast represent populations remaining behind, after the period of Indian removals from the Southeast in the 1830's and 1840's. According to Dr. Peterson, "Indian" can have at least three different meanings: legally, genetically or biologically, and ethnically or culturally.

The most important factor in the historical experience of the Gulf Coast Indians has been the effort to gain legal status as Indians through the process of being acknowledged by the Federal Government as Indian tribes or communities. Indian groups were investigated and federally acknowledged as Indian tribes. Federal acknowledgement was extended only to the major tribal groups--the Seminoles and Miccosukees of south Florida, the Choctaws of Mississippi, the Chittimachas and Coushattas of Louisiana, and the Alabama-Coushattas of Texas. The history of the remaining nonrecognized tribes centers on their effort to achieve Federal recognition.

Unlike the Northeast, in the Southeast there are relatively few state reservations or sanctioned Indian communities. In the Southeast, one finds a number of non-aggregated, acculturated Indian descendants scattered throughout the region. One-third of all petitions for Federal acknowledgement, or 34 petitions, have been submitted from Indian groups of the Southeast. Of these petitions, only eight have been evaluated, of which two groups have received federally recognized status: the Tunica-Biloxi of Louisiana and the Poarch Band of Creeks of Alabama. Of the remaining 26 petitioning Indian groups in the Southeast, only one has completed the required documentation for evaluation.

Throughout the Gulf Coast area, it is possible to run across previously unorganized and/or unacknowledged Indian descent groups. These include clearly identifiable family groups of Choctaws in the three Mississippi coastal counties and multi-tribal Indian urban communities, such as the one in Pascagoula, Mississippi, which resulted from Ingles Shipping's aggressive minority employment policy.

The federally acknowledged Seminole and Miccosukee Tribes' people and activities are primarily in south-central and east Florida around Hollywood and Ft. Lauderdale. The Poarch Band of Creek Indians is located in west Florida. The Mowa Choctaws located north of Mobile, Alabama, are in the process of documenting their petition for Federal acknowledgement. The federally acknowledged Mississippi Band of Choctaws is the only major Indian group in Mississippi. Louisiana contains three federally acknowledged tribes: Chitimacha in St. Mary Parish, Coushatta in Allen Parish, and the Tunica-Biloxi in Avoyelles Parish. Louisiana also contains five State-recognized Indian groups: the Houma; the Jena Choctaw; the Choctaw-Apache; the Clifton Choctaw; and a suburban agglomerate of Choctaws, the Louisiana Tribe of Choctaws in West Baton Rouge Parish. Texas has only one State-recognized tribe in the Gulf region--the Alabama-Coushatta east of Houston. Also, sizable urban Indian communities exist in Fort Worth and Dallas, representing migrants from Oklahoma and western states.

No assessment of the impact of oil-related activities on Gulf Coast Indians has ever been attempted. Such an assessment must take into account Federal, State, and unacknowledged groups, and must take place within a general framework for assessing human ecological (anthropological), cultural geographical, economic, and demographic change.

Dr. Barry Jean Ancelet, Assistant Professor of French and a Folklorist with the Center for Louisiana Studies at the University of Southwestern Louisiana, was originally scheduled as the eighth speaker, but was unable to attend. Dr. Ancelet's paper concerns research on Cajun culture. He reviewed early work on the history, culture, and language of the Cajuns and Creoles.

In 1968 the Council for the Development of French in Louisiana was created. In 1973, the University of Southwestern Louisiana established the Center for Louisiana History and, in 1974, initiated the Center for Acadian and Creole Folklore. The goal of these centers was to develop and archive information that would serve as the basis for research. The Center for Louisiana Studies developed collections of photographs, manuscripts, maps, and microfilm. The Center for Acadian and Creole Folklore acquired copies of field recordings.

Others have also researched these areas: the Department of Geography and Anthropology at Louisiana State University, which has investigated traditional architecture and material culture; the Acadian Studies Center at Nicholls State University; the National Park Service; Jean Lafitte National Historical Park; and the Louisiana Folklife Program of the State's Department of Culture, Recreation and Tourism. Research has also resulted in the production of films, projects such as an oral history of Terrebonne Parish, and a radio series of Cajun and Creole tales and legends. Still more research projects have involved work on colonial settlement patterns, the development of Acadian and Cajun identities, the Americanization of French Louisiana, the origins and development of Cajun music and zydeco, Louisiana French language and oral tradition, and the impact of the oil industry on Cajun and Creole cultures.

According to Dr. Ancelet, the most undeveloped area of research on the Cajuns and Creoles is linguistics. Progress on this important linguistic front would be an important complement to work in cultural and historical areas.

The ninth paper was given by Dr. Robert Gramling, Professor of Sociology at the University of Southwestern Louisiana, who spoke on socioeconomic impacts of offshore oil and gas activities on the Gulf Coast. This presentation dealt with erroneous assumptions concerning the impacts of offshore energy production.

According to Dr. Gramling, the traditional model for what has come to be called Social Impact Assessment came out of energy development in the western United States and is embodied in the "Boomtown" literature. Gramling argues that this model is not an appropriate one for the analysis of the impacts of offshore oil and gas activities because of the factors of size and mobility. In contrast to the more geographically specific types of development, the mobility associated with offshore energy exploration and development leads to diffused, as opposed to concentrated, social and economic impacts.

This mobility is evidenced in four basic areas. First, the development itself is highly mobile. Second, employees could follow the rig or commute. A third factor in the mobility of the offshore energy production industry is the transportability of many of the products that the industry buys. Finally, the products themselves, oil and gas, are also very mobile. Taken together, what these factors mean is that the positive and negative effects of offshore oil and gas are distributed widely throughout the Gulf Coast, the South, and indeed the continental United States.

To assess the impacts of oil and gas activities in the Gulf Coast, a broad network is required. Studies are needed that emphasize the various associations with the oil and gas industry that have actually changed important human interactions like homes and families, the work place, friendships, and communities. Dr. Gramling suggested that one approach to consider is Bill Freudenburg's Density of Acquaintanceship Model: community interactions should be studied in terms of socialization of youth, deviance, and support systems for the weak (old, infirmed).

Dr. Gramling stated that the concentrated work scheduling in the Gulf of Mexico petroleum industry (7 days on/7 days off, 14 days on/14 days off, 21 days on/21 days off) has to be used in other areas to minimize potential impacts. This concentrated work scheduling has been used for the exploitation of remote resources, for example, in remote mining communities in Newfoundland. The offshore work scheduling model is used to avoid massive "boom" developments. It is not economically feasible to build a new town.

The effects of a concentrated work schedule (in the Gulf Coast) are (1) greater potential to workers (e.g., commuting of north Louisiana offshore workers); (2) participation with the nuclear family is affected (less interaction); (3) families become independent social systems through crisis management; lack of input in decisions can create stress; (4) impacts on employees (it is difficult to unionize, to organize for economic benefit); (5) changes to small coastal communities; and (6) new adaptations and integrations (for example, many get a second job-different time-space management).

Dr. Gramling suggested that we can learn from the results of the MMS Alaska OCS Office, but there are limits to the applicability. We can also learn from studies conducted in Newfoundland, Norway, Indonesia, China, and in other areas of the world. The MMS should consider building a library of worldwide socio-cultural impact studies and other relevant data. Gramling argues that much new data gathered should be microsocial in nature.

After Dr. Gramling's presentation, the assembly discussed the adequacy of currently available Gulf Coast socio-cultural studies. The studies are used to assess the effects of MMS leasing and regulation of operations, and to solicit recommendations as a "scoping" effort for the directions of possible future MMS studies. Dr. Spitzer suggested that MMS might proceed at a variety of levels for future studies. He stated that the international culture of work is something of a constant, although the way a Vietnamese and Cajun family handle the scene are going to be different. Another level is microcultural or ecological; a third level is a broader ethnographic approach in areas where cultures have not been well studied. Dr. Spitzer further suggested that MMS should review the cultural conservation report and should consider the option of completing studies in-house.

Dr. John Peterson suggested that MMS studies should look at the linkage of the human, marine, and coastal environments; the cultural ecology should be studied--the relationship of socio-cultural impacts as related to the broader environment. Dr. Brent Smith stated that the MMS coastal characterization studies have taken this thrust and that a human ecological approach is one being considered for an MMS study--looking at socio-cultural elements relative to the natural and physical environment.

Dr. Smith further stated that there are different levels of effects of offshore oil and gas activities: primary, secondary, and tertiary. For example, employment is a much more direct effect than petrochemical refining and manufacturing. Mr. C. Ray Brassieur stated that an effect assumed to be tertiary might be very significant cumulatively. Dr. Smith responded that the National Environmental Policy Act (NEPA) requires that socio-cultural effects must be tied into the effects on the natural environment to relate to NEPA requirements. Dr. Smith stated that if MMS had never leased and regulated offshore oil and gas activities, Cajuns and other cultures and sub-cultures may have been different from what they are today.

Dr. William Freudenburg, Professor of Sociology at the University of Wisconsin and member of the MMS Scientific Advisory Committee, stated that MMS's duties are to understand what the impacts of its activities are on the human and cultural environment and to mitigate those impacts. MMS has done limited socio-cultural work in the Gulf. Dr. Freudenburg suggested that MMS should start with a range of case studies, carefully selected to give some diversity, balance, and range, in order to develop hypotheses about cause/effect relationships. These case studies should focus on what is happening now, possibly focusing on groups who are the most sensitive to development or to the oil and gas bust; what is happening elsewhere in the world--as mitigation options and lessons to learn; and the historical record, looking at the Gulf Coast and elsewhere in the world, as ways to generate hypotheses. This research effort should be done as a 3- or 4-year study. The first year should involve reviewing available information and developing hypotheses; the second and third years should involve testing hypotheses for individually studied groups.

Dr. Peterson stated that MMS might consider funding a few case studies initially instead of planning a massive study because of the uncertainty of funding.

Dr. Smith stated that one of the alternatives that has been discussed is to gather information (published and unpublished) and, at the same time, do some pilot studies of higher priority areas or situations that might be more sensitive as far as changes, such as the boom/bust cycle. Dr. Smith asked, "If we need to prioritize various areas of study (geographic communities, groups, etc.), do we have any sense of which might be of greatest interest?"

Dr. Peterson responded that he would not take a community or group approach. He would put it in terms of an ecological approach, a topical approach (e.g., family approach). For costs and the massiveness of impacts, Louisiana has to be a high priority.

Dr. Spitzer asked whether it is possible to consider a major, broad survey of the Gulf Coast as a whole. This survey would include microstudies related to cultural ecology, the continuity and discontinuity of culture based on exploitation of resources, rather than basing it on ethnicity.

Dr. Freudenburg stated that ultimately MMS does have to look at the entire Gulf area of responsibility where there is, or will be, oil development. MMS needs to work at developing testable hypotheses based on more than a survey of available information. Dr. Freudenburg suggested that it would be possible to start doing work in Morgan City tomorrow, but MMS should be selective. Dr. Freudenburg stated that it is necessary to know enough about the culture to understand how the people living in the culture are to be affected by OCS oil and gas development.

Dr. Spitzer stated that there are a lot of studies (National Park Service and others) that have already been done. One option is for MMS staff to survey the literature and to develop the hypotheses in-house. The social science discipline can help with microstudies or macrostudies, but ultimately the responsibility for integrating all of that information is MMS's.

Mr. J. Kenneth Adams of MMS asked, "If MMS has a development scenario that consisted of exploration, development, and production off of Tampa, Florida, would it be possible to predict what would happen to the Greek sponge fishers (for example)?" Dr. Gramling and Dr. Peterson responded that it was possible. Dr. Gramling stated that it was possible with a high degree of reliability for sponge fishing, tourism, dock space, and the fishing industry. There are different strategies to mitigate what would happen; for example, one of the strategies is to hire only workers from Louisiana. Dr. Gramling further stated that he was involved in a environmental impact statement for development and production activities off Mobile, Alabama. The total impact to the city of Mobile was water and diesel fuel usage and the employment of two part-time dock workers to lay pipe. Other goods and services were to come from Louisiana.

Dr. Spitzer stated that you cannot isolate just the Greek sponge fisherman. In the real world you cannot convince the Floridians that their unemployed worker should not be working on the rigs. There will be local political questions regarding the unemployed or underemployed people in that area. Inevitably, whether your predictive model says that you can mitigate the problem, there will be things happening as a result: economic, social, cultural, and environmental.

Mr. Brassieur stated that what really happens is that Greek fishermen end up on the bottom of the pile. Dr. Spitzer added that they are told that their problems have been mitigated. Mr. Brassieur asked, "Right now, while we can see it happening, should we try to salvage some of the traditions?" There are cultural conservation ethics to consider. Dr. Peterson responded that the more fundamental question is, "Should people be informed about the potential of cooperative decision-making?"

Dr. Spitzer responded that if certain people in the French community and other related communities had known that the boom and bust cycle would have been this way, they might have made some very different strategies related to their culture and cultural ecology. People need to have the ability to choose, and the only way they can choose wisely is to be informed.

Dr. Gramling stated that an isolation and containment model was developed for use in the North Sea, which factored in development over "x" number of years and employment of "x" number of people. The oil and gas industry also knew if they employed local people, the local woolen industry would suffer, so the oil and gas industry isolated it and hired everyone from the outside. Mr. Adams stated that we cannot really have any control over that. Dr. Gramling responded that MMS can make the information available.

Dr. Brent W. Smith is a Social Scientist with the MMS, Gulf of Mexico OCS Regional Office. His responsibilities with MMS include environmental and socio-economic impact assessment for offshore operations. Dr. Smith obtained a B.A. in anthropology from Louisiana State University (1970), an M.A. in social sciences from Northwestern State University of Louisiana (1974), and a Doctorate in Public Administration from Nova University (1986).

Mr. William T. Johnstone is a Community Planner with the MMS, Gulf of Mexico OCS Regional Office. His responsibilities with MMS include extensive coordination of the Environmental Impact Statement required prior to oil and gas lease sales, air quality analysis, and an involvement in several studies concerned with environmental issues. He obtained a bachelor's degree from Ohio State University in 1957 and a Master of Regional and City Planning degree from Oklahoma University in 1971.

MARINE MINERAL RESOURCES IN THE GULF OF MEXICO

Session: MARINE MINERAL RESOURCES IN THE GULF OF MEXICO

Co-Chairs: Mr. John B. Smith
Dr. Chacko J. John

Date: December 3, 1987

Presentation	Author/Affiliation
Marine Mineral Resources in the Gulf of Mexico: Session Overview	Mr. John B. Smith Minerals Management Service Office of Strategic and International Minerals and Dr. Chacko J. John Louisiana Geological Survey
Joint Federal/State Task Force Studies of Marine Minerals in the Gulf of Mexico	Mr. John B. Smith Minerals Management Service Office of Strategic and International Minerals
Louisiana Nearshore Sand Resource Inventory	Dr. John R. Suter and Mr. Shea Penland Louisiana Geological Survey Coastal Geology Program
Assessment of Nonenergy Mineral Potential in Offshore Alabama: Phase I, Analysis of Available Geophysical and Bottom Sample Data	Mr. Bennett L. Bearden, Mr. William E. Smith, and Mr. Berry H. Tew Geological Survey of Alabama
Preliminary Assessment of Nonenergy Mineral Resources Offshore Mississippi	Ms. Robin Cranton and Dr. J. Robert Woolsey Mississippi Mineral Resources Institute
Preliminary Assessment of Non-Fuel Mineral Resources of the Texas Continental Shelf	Dr. Robert A. Morton and Mr. William A. White The University of Texas at Austin Bureau of Economic Geology
Outlook for Offshore Shell Dredging	Mr. Robert D. Palmore Dravo Basic Materials Co., Inc.
Incentives for Deep Ocean Mining	Mr. John G. O'Hara Offshore Mining Company

Session: MARINE MINERAL RESOURCES IN THE GULF OF MEXICO (cont'd)

Presentation Title	Author/Affiliation
History of the Beach Nourishment Project, Grand Isle, Louisiana	Mr. Adrian J. Combe, III U.S. Army Corps of Engineers New Orleans District
The Outlook for Offshore Heavy Minerals Resources	Mr. Mark S. Whitney Associated Minerals (USA), Inc.

Marine Mineral Resources in the Gulf of Mexico: Session Overview

Mr. John B. Smith
Minerals Management Service
Office of Strategic and
International Minerals
and
Dr. Chacko J. John
Louisiana Geological Survey

On December 31, 1986, Secretary of the Interior Donald P. Hodel and the Governors of Alabama, Louisiana, Mississippi, and Texas announced an agreement to establish a joint Federal/State task force to study the occurrence, location, and economic feasibility of developing marine mineral resources offshore those states. This Gulf Task Force (GTF) is jointly co-chaired by representatives from the MMS, the Alabama Geological Survey, the Louisiana Geological Survey, the Mississippi Mineral Resources Institute, and the Texas Bureau of Economic Geology.

The GTF is currently conducting an economic reconnaissance study to identify mineral commodities and geographic areas of potential commercial interest. The economic reconnaissance study is scheduled to be completed by October 1988 and its findings presented at the 1988 Gulf of Mexico ITM. The Marine Minerals Session of the 1987 ITM provided an opportunity for GTF members to review the status of the economic reconnaissance study and to disseminate information regarding the preliminary findings of the GTF to the general public, industry representatives, academia, and other interested parties. The agenda for the session included presentations by 10 speakers representing various Federal, State, academic, and private industry groups.

The Marine Minerals Session began with a presentation by Mr. John B. Smith of the MMS's Office of Strategic and International Minerals (OSIM), who, along with Dr. Chacko John of the Louisiana Geological Survey, co-chaired the session. Mr. Smith reviewed the role of OSIM and the purpose of the GTF. He stated that OSIM was established in 1983 to develop a leasing and regulatory program for administering marine minerals exploration and development on the Outer Continental Shelf/Exclusive Economic Zone (OCS/EEZ) under the authority provided by the OCS Lands Act. He emphasized that MMS/OSIM is working closely with the coastal states in developing a marine minerals leasing program for the OCS/EEZ. This is being accomplished through joint Federal/State task forces that have been established to facilitate cooperative investigations of marine minerals located within the territorial sea and on Federal submerged lands.

Mr. Smith reported that the economic reconnaissance study being conducted by the GTF will involve the compilation and synthesis of existing data to make preliminary evaluations of the occurrence, location, and economic feasibility of developing marine mineral resources in the Gulf. Such data will include high resolution seismic reflection profiles, side-scan sonar records, surface sediment samples, gravity cores, vibracores, and soil borings. He stated that the scope of the study is restricted to an assessment of the offshore area, extending from the shoreline to the 200-meter water depth contour level. Resources of interest to the study include sand and gravel, heavy minerals, and shell.

Following Mr. Smith's presentation, Dr. John Suter (Louisiana Geological Survey), Mr. Bennett Bearden (Alabama

Geological Survey), Dr. Robert Morton (Texas Bureau of Economic Geology), Ms. Robin Cranton, and Dr. Robert Woolsey (Mississippi Mineral Resources Institute) presented overviews of relevant technical information currently available in each of their respective states. Dr. Suter discussed the serious coastal erosion and landloss problems being experienced in Louisiana and the State's reconnaissance efforts to investigate the utilization of offshore sand deposits for possible beach nourishment projects. Other speakers focused on information sources on marine minerals located offshore their respective states, the methodology being used to identify minerals of potentially commercial interest, and the quality of the data base.

Speakers from industry included Mr. Don Palmore from Dravo Basic Materials Company, Mr. John O'Hara from Offshore Mining Company, and Mr. Mark Whitney from the Associated Minerals Company. They encouraged federally sponsored mineral investigations and environmental baseline studies of marine minerals, particularly field-oriented studies that involve mapping and sampling programs.

In discussing hurdles to marine mining, Mr. O'Hara expressed the opinion that a legal framework was lacking, both internationally and domestically, that encouraged investment in the development of "deep seabed" mineral resources. Several industry speakers also emphasized that the absence of rules and regulations for marine mining was a major deterrent to exploration and development on Federal submerged lands.

Several industry speakers also stated that environmental problems were a major concern, particularly the permitting requirements of State and Federal regulatory agencies. All of the industry representatives felt that there should be more dialogue, communication, and coordination between Federal and State agencies and industry. They were hopeful that the joint Federal/State task force approach would provide an effective mechanism for such coordination.

Mr. Whitney discussed Associated Minerals' experience in exploring for offshore heavy mineral resources and identified specific topics requiring further research. He concluded by stating that his company was optimistic about offshore minerals, but emphasized that much more work is required to better understand the commercial potential of the resources.

Mr. Adrian Combe of the U.S. Army Corps of Engineers described the history of the beach nourishment project at Grand Isle, Louisiana. This project involved dredging 5.5 million cubic yards of material from two offshore borrow pits during 1983 and 1984. In his presentation, he discussed erosion problems that resulted from several large storms in 1985 and presented recommendations for restoration of the project.

Mr. John B. Smith is a geologist with the MMS, Office of Strategic and International Minerals (OSIM) in Long Beach, California. He holds a B.S. degree in geology and obtained his M.S. degree in mineral economics from Pennsylvania State University. He was employed as a geologist and mineral economist with the Department of the Interior's Bureau of Mines from 1976 to 1984. In 1984, he joined the staff of the newly established OSIM. Mr. Smith presently serves as Department of the Interior Co-chairman of the Joint Federal/State Gorda Ridge Technical Task Force and the Gulf of Mexico Task Force.

Dr. Chacko J. John received his B.Sc. and M.Sc. degrees in geology from the University of Nagpur, India, in 1966 and 1968, respectively. He then worked as an Instructor in Geology at the University of Kerala in Trivandrum, India, and as Geologist-in-charge of English India Clay Mines, also located at Trivandrum, India. He later attended the University of Delaware at Newark, Delaware, and obtained his M.S. and Ph.D. degrees in geology. Prior to joining the Louisiana Geological Survey in April 1987, where he serves as Research Associate and Project Coordinator for the Gulf Coast Task Force on the Exclusive Economic Zone Project, Dr. John worked as advanced geologist with Marathon Oil Company at Lafayette and Houston for six years in development and exploration. He is a member of numerous professional organizations and has a number of publications to his credit.

CURRENT PREHISTORIC ARCHAEOLOGICAL RESEARCH IN THE COASTAL REGIONS OF FLORIDA

Session: CURRENT PREHISTORIC ARCHAEOLOGICAL RESEARCH IN THE COASTAL REGIONS OF FLORIDA

Chair: Mr. Richard J. Anuskiewicz

Date: December 3, 1987

Presentation Title	Author/Affiliation
Current Prehistoric Archaeological Research in the Coastal Regions of Florida: Session Overview	Mr. Richard J. Anuskiewicz Minerals Management Service Gulf of Mexico OCS Region
Inundated Archaeological Sites of the Florida Coastal Region: A Regional Overview	Ms. Melanie J. Stright Minerals Management Service Gulf of Mexico OCS Region
A Consideration of Archaeological Wetsites	Dr. Glen H. Doran Florida State University Department of Anthropology
Results and Implications of the Multidisciplinary Archaeological Research Project at Warm Mineral Springs, Florida	Mr. Wilburn A. Cockrell Florida State University Department of Anthropology
Some Archaeological Sites in the Apalachee Bay of Florida	Mr. Michael Faught University of Arizona Department of Anthropology
Preliminary Archaeological Investigations at Ray Hole Spring	Mr. Richard J. Anuskiewicz Minerals Management Service Gulf of Mexico OCS Region
Archaeological Sites in the Drowned Tertiary Karst Regions of the Eastern Gulf of Mexico	Mr. James S. Dunbar Florida Department of State Bureau of Archaeological Research

Current Prehistoric Archaeological Research in the Coastal Regions of Florida: Session Overview

Mr. Richard J. Anuskiewicz
Minerals Management Service
Gulf of Mexico OCS Region

The MMS of the Department of the Interior is responsible for all OCS minerals activities and their potential for impacting natural and archaeological resources. In order to fulfill its responsibilities for archaeological resources management, MMS has developed a program to inventory, manage, and protect valuable, nonrenewable, prehistoric and historic resources. The MMS meets its goal of archaeological resource protection through a multilevel analysis system. The MMS conducts Regional baseline studies to determine where on the OCS archaeological sites are most likely to occur.

The MMS baseline studies have concentrated on the central and western Gulf of Mexico because most of the oil and gas exploration and production has occurred in this area of the Gulf. However, the recent past has seen the projection of exploration and development of natural resources in the eastern Gulf of Mexico. Regionally-specific archaeological resource management models were originally derived from this baseline data for analysis and management of prehistoric archaeological resources potentially located in the western and central Gulf of Mexico. However, the models are not completely applicable for archaeological analysis in the eastern Gulf of Mexico. In an attempt to resolve this problem, MMS has enlisted the aid of archaeologists conducting current prehistoric research in the coastal regions and offshore Florida. This has been done in order to examine new information from their current research that may be applicable to the MMS cultural resource management program for the eastern Gulf of Mexico.

The focus of this session is to report on the current status of prehistoric archaeological research in the coastal regions of Florida and then to determine if the present analytical models used by MMS, derived from previous baseline studies, are appropriate for performing the requisite MMS cultural resource management analysis.

The first speaker in our session was Ms. Melanie J. Stright of MMS. Ms. Stright began the session by giving an archaeological overview of inundated archaeological sites in the coastal regions of Florida. She reported that 17 inundated archaeological sites have been documented within the coastal area of Florida. These sites became inundated as a result of glacio-eustatic and glacio-isotatic adjustments during the late Wisconsinan glacial epoch and during the Holocene. The distribution of sites should not be considered representative of the true distribution of inundated archaeological sites. There is a strong bias towards shallow water sites since activities such as dredging and sport diving generally concentrate in shallow waters and have led to the discovery of many of the sites.

Diagnostic artifacts recovered include lithics and pottery and span all cultural periods from Paleo-Indian through the Woodland. Human skeletal material from Paleo-Indian and Late Archaic Periods have been recovered, as well as numerous species of late Pleistocene fauna.

The inundated archaeological sites discovered thus far within the coastal areas of Florida suggest that there will be an abundance of archaeological material found off the coast of Florida and that these materials (including organics) will often be well preserved. Sites will probably concentrate in the vicinities of sinkholes, relict fluvial channels, relict estuarine deposits, and outcrops of cryptocrystalline rock. Information contained in these sites may provide important information on prehistoric human migration, settlement patterns, subsistence, and cultural contacts across now submerged landmasses.

The next speaker was Dr. Glen Doran of Florida State University. His paper focused on the preservation potential of organic materials at prehistoric archaeological sites located in wet or saturated environments. He defined these types of archaeological sites, or "wetsites," as locations where remnants of past human activities are preserved in saturated or nearly saturated settings. These types of sites can be found in river channels, coastal marine settings, and within lakes, ponds, and springs. However, there may be some problems in locating wetsites because of their almost invisible nature and the frequent necessity of entering a "hostile" environment to locate them. Wetsites are either underwater, or they are difficult to identify because of water-saturated conditions.

The potential preservation of organic materials is largely due to the presence of moisture, which reduces the physical stress on organic materials by limiting the frequent hydration/dehydration cycle that promotes deterioration of organic remains by expansion and contraction. There are many other factors that contribute to the preservation potential of materials. These factors include the dynamics of water and/or soil chemistry, oxygen levels in the soil and water, temperature, physical stability, and integrity of the soil matrix. When all of the environmental conditions are right, there is also a good potential for preservation of plant material like stems, seeds, leaves, and pollen. Additional soft tissue that can survive includes preserved brain tissue. At the Windover archaeological wetsite, which Dr. Doran has been excavating since 1983, Dr. Doran states that the preliminary analysis of preserved brain tissue indicated a replacement process, that resulted in elevated sulfur levels. Microscopic and macroscopic features of the brains are still preserved, as are some molecular structures. Elemental analysis of bone samples indicates an abnormal absorption of strontium, obviating some studies of dietary composition based on strontium levels. At the same time, some proteins appear well preserved enough for researchers to attempt to develop a biological profile of the 7,000 year old population being studied.

The uniqueness of the preservation of organic materials at wetsites like Windover also presents some unique problems in material preservation. Waterlogged conditions of archaeological material recovered necessitated special conservation techniques. Saturated faunal and human bone was treated with bulking agents which replaced the water. Polyetholglycol (PEG) was initially used, but an acrylic emulsion, Rhoplex, proved more satisfactory. Floral materials (seeds, leaves, wooden artifacts, etc.) involved a variety of conservation procedures including refrigeration, alcohol saturation, treatment with PEG and Damar, and other compounds. Brain tissue was rapidly removed, placed in plastic bags, flooded with nitrogen gas, sealed, refrigerated for transport, and frozen at -70 degrees centigrade within 24 hours to minimize possible degradation and to maximize future analysis possibilities.

Many scientific and archaeological accomplishments were realized at the Windover prehistoric wetsite. The collection, representing a minimum of 155 adults and subadults, is one of the largest samples of human skeletal material and associated cultural materials of this antiquity in the New World. The collection dates between 7,000 and 8,000 years Before the Present (B.P.) and represents an Archaic Period hunting-gathering population. Data on health, diet, disease, demography, etc., in some ways, represent "baseline data," useful in looking not only at human adaptation, but providing an abundance of archaeological, climatological, and environmental data.

Mr. Wilburn A. (Sonny) Cockrell, Director of the Warm Minerals Springs Archaeological Research Project, was the next speaker, and he described his archaeological site as a 70-meter deep spring-fed sinkhole, located 16 kilometers inland from the Gulf of Mexico in Sarasota County, Florida. Saline anaerobic water enters the sinkhole at the 70-meter depth at a temperature of 32-34 degrees centigrade. The source of the springs' water is the Floridian Aquifer some 1,000 meters below the surface. Approximately 19.4 million gallons of natural, hot mineral water flow through the spring each day.

The sinkhole's limestone walls are draped intermittently with dripstone formation zones from 4 to 30 meters below the surface. In addition, some of the underwater sediments are producing a tufa-like formation. This sedimentary rock, composed of calcium carbonate, is formed by evaporation as a thin, surficial, soft, spongy, cellular or porous, semifriable incrustation around the mouth of a hot spring. The limestone matrix of the spring is representative of the Hawthorn Formation, which dates back to the Miocene Period.

Current research is being conducted on a 13-meter ledge, and at the sinkhole's debris cone at a depth of 50 meters. The archaeological diving is being conducted by utilizing both SCUBA and surface supplied air systems. The technology utilized at Warm Mineral Springs reflects both standard underwater excavation methods at the 13-meter ledge and some new and innovative techniques at the 50-meter level where deep diving is required.

There are three archaeological foci at the Warm Mineral Springs archaeological site. They include (1) a terrestrial site located around the rim of the sinkhole, (2) archaeological material at the 13-meter ledge deposited prior to the present level of inundations, and (3) a stratified matrix of undisturbed natural sediments and archaeological materials located in the existing sediment cone at the 50-meter level.

Archaeological material excavated at Warm Mineral Springs ranges from the present to the Formative Period (approximately 2,500 years B.P.), from the Formative to the Archaic Period (approximately 2,500 B.P. to 8,500 B.P.), and from the Archaic Period to the Paleo-Indian Period (approximately 8,500 B.P. to 11,000 B.P.). Archaeological materials excavated from the Paleo-Indian period have been radiocarbon dated to approximately 11,000 B.P. Stratigraphic and chronologic analysis of the archaeological materials excavated indicates that human and other animal faunal remains, such as the ground sloth, saber-tooth tiger, horse and camel, were found to coexist during the same time period. Analysis of preserved botanical remains has provided a continuous paleo-environmental record extending back approximately 30,000 years B.P. In addition, there have been unsubstantiated reports that cave divers in the early 1960's removed a skull from the 13-meter ledge area of the spring and that this skull contained preserved brain material.

Planned future excavations of the anaerobic sediment cone at the 50-meter level may provide a complete time continuum of this archaeological site and, perhaps, provide more preserved faunal material and preserved soft tissue.

The fourth speaker was Mr. Michael Faught, a graduate student from the University of Arizona. His topic involved locating and excavating underwater prehistoric archaeological sites in the Apalachee Bay area of Florida, located in the northeastern area of the Gulf of Mexico. Mr. Faught suggested that anthropologists are somewhat puzzled by the archaeological reconstruction of the cultural transition from the Paleo-Indian Period to the Archaic Period. In the same vein, Quaternary geologists are having similar problems reconstructing the geolomorphical transition from the Pleistocene to the Holocene Period. Both disciplines are acutely aware of the need to study sea level changes and the need to continue to collect paleo-environmental data from the continental shelf. The missing archaeological and geological data includes information about relict geomorphology, prehistoric settlement patterns, and the timing and effects of sea level change on these factors. There has been much written in the archaeological literature about sea level curves; however, very little archaeological research has been conducted on the continental shelf to locate inundated sites to substantiate or dispute existing sea level curves for finding additional prehistoric sites of a terminal Pleistocene age (Paleo-Indian Period).

Mr. Faught further stated that the continental shelves represent a missing and potentially large data set where it is extremely difficult to find either relict topographic and geologic features or submerged archaeological sites. Wave action destruction, subaerial erosion, Holocene alluviation, and neritic sedimentation are significant natural processes that could obscure the Pleistocene geology and continental shelf archaeology.

The search for submerged or drowned prehistoric terrestrial sites by Mr. Faught began after careful examination of onshore settlement pattern models for late Archaic and Paleo-Indian Periods. Research was focused on upland areas of high-density, extinct faunal remains and their associated lithic artifacts and on a potential offshore survey area that exhibited minimal alteration to the natural geology since the Pleistocene. A preliminary predictive model and research design were developed to search for lithic procurement stations, theorizing that lithic cultural material would have the best possibility of surviving natural destructive forces of sea level changes through time. The selected survey area included nearshore regions of the St. Marks, Aucilla, and Econfina Rivers of the Apalachee Bay because the alluvial sedimentation in these rivers is extremely low due to the solutional characteristics of the karst drainage.

The results of the initial survey located four lithic procurement stations in the five areas examined. Three sites were found close to shore in approximately 2 meters of water.

The fourth site was located 4.02 kilometers offshore at a depth of 3.7 meters and produced a large number of modified lithic materials including bifacially trimmed cores and associated flakes. Associated with the lithic debris were pieces of cypress wooden, which radiocarbon dated to 5,160 ± 100 years B.P.

The preliminary results of offshore archaeological surveys in the Apalachee Bay region indicate that by utilizing the developed predictive model, drowned prehistoric archaeological sites can be located. By examining relict features in the inundated karst region and concentrating on surveying the associated rock outcrops, site location is highly predictable.

Mr. Rik Anuskiewicz of MMS was the next speaker, and he reported preliminary archaeological investigations at Ray Hole Spring, a submerged karst feature located on the OCS. The MMS, in cooperation with the Florida Bureau of Archaeological Research, conducted preliminary underwater archaeological investigations at Ray Hole Spring. This submerged karst feature is located approximately 88.5 kilometers southeast of Tallahassee, Florida, and about 38.6 kilometers from the nearest Florida landfall. The Spring is a typical karst feature probably formed during the Pleistocene as a result of the surface limestone collapsing because of either solutional or mechanical action caused by underground drainage.

A 1976 Florida Bureau of Geology bulletin, titled "Springs of Florida," describes Ray Hole Spring as an occasional flowing spring lying in 11.6 meters of water, measuring 7.6 meters in diameter. The north side of the sink slopes southeast with the southeast side of the sink having a nearly vertical limestone wall to a depth of 18 meters. A cave strikes down and southeast from the 18-meter depth to approximately 30 meters.

The October 1986 investigation of the spring revealed a completely different environmental setting at the site. The diving reconnaissance indicated that the spring had almost completely filled in with recent (since 1976) marine shell detritus. Only about 3 meters of relief existed in the southeastern end of the sink. The archaeological investigation of the site included diver swimming reconnaissance, mapping, attempts at coring, and waterjet excavation of selected test units. Coring was discontinued because the coring tool made very little penetration in the shell matrix as a result of the small core diameter and the large size matrix of the marine shell detritus. After negative results from Test Units 1 and 2, and Core Tests 1 and 2, testing was moved to the outer rim of sink. One dive team began excavating with the waterjet at a large crevice. It was theorized that if this were an archaeological site, cultural material may have fallen or have been washed into a crevice and become trapped. The crevice was approximately 15 cms in width and ran in a southwesterly direction towards the rim of the sinkhole. Waterjet excavation approximately 15 to 20 cms into the crevice recovered several poor quality limestone or chert flakes. This material was immediately returned to the surface for examination. Continued waterjet excavation of the crevice yielded a lens of articulated whole oyster shell at the 75 cm level; at the one-meter depth, waterlogged wood was encountered. Samples of the shell and wood were collected, returned to the surface, and stabilized for future analysis. Below where the wood samples were recovered, the crevice narrowed and bottomed out. Excavation was terminated as was the initial archaeological testing.

In April 1987, analysis was conducted on the oyster and wood samples to identify the species and to obtain a radiocarbon date of this organic material. The wood species was identified as live oak, and radiocarbon dates for the oyster shell and wood dated 7,390 ± 60 years B.P. and 8,220 ± 80 years B.P., respectively. The wood sample, dating approximately 800 years older than the oyster shell and being recovered in a lower stratigraphic level than the oyster shell, suggests that these materials were deposited in situ.

Preliminary analysis of the data collected at Ray Hole Spring suggests that this sinkhole may be a prehistoric archaeological site. Several factors (environmental and possibly cultural) tend to support this initial contention. The radiocarbon dates obtained at Ray Hole Spring in combination with the regional sea level curve indicate that for approximately 8,200 years B.P. the sinkhole was a freshwater site supporting freshwater flora. Some time after 8,200 B.P., sea level began to rise, and by 7,400 B.P., the Ray Hole Spring area was supporting a shellfish population in a brackish water environment.

In addition, a cultural manifestation may exist at Ray Hole Spring. The two large limestone/chert flakes collected were examined by five archaeologists. They all seem to agree that the way the flakes were removed from the lithic core suggests that they could have been made by prehistoric man. However, they also agree that two flakes usually do not make an archaeological site.

Obviously, there is more work to be done to fully verify if Ray Hole Spring is an authentic archaeological site. An intensive testing program includes remote sensing studies to determine the true depth and profile of the sink hole, coring of the sediment cone to gather paleo-environmental data, more organic sample collecting for radiocarbon analysis, and the recovery of diagnostic lithic artifacts.

The final speaker of our session was Mr. James Dunbar, archaeological field supervisor with the Florida Bureau of Archaeological Research, Department of State. Mr. Dunbar began his comments by stating that prehistoric archaeological sites inundated by the sea are the most elusive sites to locate. The sites may be deeply buried and inaccessible in some regions of the continental shelf and shallow, but difficult to identify in other areas. The karstic area of the Florida Gulf Coast represents a unique archaeological area where Paleo-Indian remains are highly concentrated and sedimentation has been minimal.

Given the difficulties associated with locating offshore sites, a model based on the type and distribution of sites on the adjacent coast was developed for the Apalachee Bay region of the Gulf of Mexico. Offshore survey work (report by Faught and Anuskiewicz this session) incorporated the assistance of fisherman and sport divers familiar with the project areas. In three days, Mike Faught's survey located four archaeological sites from one to four miles offshore. Rik Anuskiewicz and others surveyed Ray Hole Spring some 24 miles offshore and discovered evidence of what may prove to be a drowned archaeological site.

Mr. Dunbar found from his research that prehistoric site distributions in Florida occurred in changing patterns not only linked to evolving technologies but to fluctuations in the regional surface water systems. The availability of potable water in relation to other needed resources helped dictate possible site locations through time. Ninety percent of the Paleo-Indian sites containing Clovis, Suwannee, or Simpson projectiles are located near karst depressions that penetrate the Tertiary limestones of Florida. Some sites are located around isolated sinkholes and solution depressions, but most occur in areas where multiple karst features occur together and dominate the topography. The largest site clusters are located in and around mature karst river channels with smaller but significant clusters centered around karstified lakes, bays, and prairies.

1. At given points in time, from 15,000 to 5,000 years B.P., can absolute sea level stands be identified to allow chronologically evolving site predictive models?

2. Do archaeological sites exist in the eastern Gulf of Mexico that have stratigraphic integrity despite Holocene sea level transgression and marine erosive conditions?

3. What is the functional variety of archaeological sites encountered?

4. Once prehistoric offshore sites are located, can remote sensing instruments provide diagnostic signatures of the known sites?

Mr. Richard J. Anuskiewicz obtained his B.A. in 1972 and his M.A. in 1974 from California State University at Hayward. He was employed with the U.S. Army Corps of Engineers from 1974 to 1984 as a terrestrial and underwater archaeologist. In 1982 Mr. Anuskiewicz completed all requirements for his Ph.D., except for his dissertation, at the University of Tennessee at Knoxville. In 1984, he accepted a his current position at MMS, Gulf of Mexico OCS Region.

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